

WHAT'S WRONG WITH YOUR FACTORY,
OFFICE, OR WORKS ?



A SECTION OF A SMALL WOOD-
WORKING FACTORY WHICH IS ONE
OF THE CHEAPEST SUPPLIERS OF
ITS KIND IN GREAT BRITAIN



PLATE I

ORDER SYSTEM, AND METHOD IN A
GARAGE



THE FINE SYSTEM OF INSPECTION
APPLIED TO A CLEANING AND
WASHING PROCESS FACTORY

WHAT'S WRONG WITH YOUR FACTORY, OFFICE, OR WORKS?

BY

W A MELHUISE

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FORMER LECTURER ON FACTORY ORGANIZATION
MODERN DEVELOPMENTS IN WORKS AND OFFICE PRACTICE
PURCHASING AND TENDERING ETC
AT THE MANCHESTER HIGH SCHOOL OF COMMERCE
NORTH-WESTERN POLYTECHNIC LONDON
WANDSWORTH STREET TECHNICAL INSTITUTE LONDON ETC

WITH FIVE PLATES IN HALF-TONE AND
TWENTY-TWO DIAGRAMS IN THE TEXT



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PREFACE

EVEN in these days of so-called highly organized business enterprise and productive achievement there can be found at any one moment large numbers of harassed business-men, owners and directors, whose outstanding problem is to discover some means of ascertaining just what is wrong with their factories and workshops, and how to commence to put things right

This problem is by no means restricted to any one type of manufacture or size of business, but applies in varying degrees to all classes and sizes of concerns

Common as such organizational problems are in even the extremely large concern, it is, however, in the small and medium-sized businesses that the position is more acute. Here those responsible for direction and management, being devoid of the means of delegating responsibility, as in the larger and wealthier organizations, to a team of high-salaried executives and specialists, have perforce to struggle with the problem with very little assistance, if not actually alone

In such circumstances it is not surprising that many of those responsible for running the smaller businesses which form the backbone of British Industry find themselves sadly in need of a guide as to just what type of systems and methods are really necessary to promote a highly successful and efficient business

This book aims to meet this need in an essentially practical way. The chosen method of approach is the recounting of examples of methods which have been used with success in a large number of factories of varying sizes in a number of different types of manufacture both in Great Britain and overseas

By this means it is hoped that the reader, whether engaged in a large or small factory, in whatever type of manufacture and however specialized, will at least find some matter applicable to his needs which can, with very little adaptation, be applied with use and profit to the problem on hand

With this end in view, every precaution has been taken to deal with the subject on a most practical basis, keeping to tried and proved business methods as against the expounding of lofty theories. In addition every attempt has been made to cite methods within the reach of the many and to avoid details of costly and elaborate systems only possible of application in very limited channels within the framework of the huge organization

W A M

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CHAPTER I

PROBLEMS OF THE MANUFACTURER

A MANUFACTURER once said that nearly all his staff knew just what was wrong with his business and how to put things right—the only trouble being that each one thought differently

Despite this seemingly wise reflection, a very unhappy sequel followed. The manufacturer faced with such a diversity of opinion was unable to decide on any single remedy, and so went out and played golf. In course of time he became so proficient at playing golf that the only method which was introduced into his business was that finally enforced by the appointed liquidator.

Strange as it may seem, this is by no means an unusual case. True, the activities of a manufacturer while not attending to his business varies according to his taste, but the result is the same, as many businesses have found to their cost over the last twenty years. The moral applies equally to that host of businesses which, although by some freak of fortune they seem ever able to stave off the day of final reckoning, are nevertheless in a perpetual state of anxiety as to the size of the overdraft or the quoted price of the company's shares.

In direct contrast to this Nero policy is that of the manufacturer who becomes obsessed with the idea of systems, and, with little thought as to their suitability, use, or application, introduces one after another in rapid succession. In one business where these conditions had ruled for some time the entire works order system was in a state of chaos. The staff, after vainly trying to introduce and master one system after another without respite, had at last, in self-defence, taken the line of least resistance and adopted a passive attitude to all methods, irrespective of their value, which the management desired to introduce.

In the half-way camp between these two types stands the manufacturer who, although conscious of the need for organization, encounters each and every suggested improvement with "but you can't do that in *this* business." This type—usually of the founder-class, struggling with a business grown far beyond his control—remains adamant until evidence is given that his most feared competitors have thought fit to adopt the improvement themselves.

Of the many problems, however, that are encountered in businesses of varying types and sizes, probably the worst to overcome is that of apathy. This unfortunately is only too frequently found in a great many concerns. It is a defeatist attitude that owes its existence largely to the mistaken belief that organization in its truest form is in reality the sole prerogative of the large mass-producer, and as such is just another

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of the advantages denied to those in a small way of business or concerned with the production of a variety of products. How far from the truth this really is can be gleaned from the fact that some of the best-organized concerns in the world are not the large mass-producers of a single product, as is generally believed, but companies of average size who, without the advantages of the former, have nevertheless succeeded in putting their house in order in no uncertain way.

Many others could follow their example if the fact were only recognized that, although organization as applied to different concerns naturally varies to suit the peculiar requirements of each, its principles are constant and are equally applicable to all sections of industry and commerce. Indeed, acceptance of this is essential if one is to promote a highly successful business, freed from the ever-present problem of *what is wrong with my factory, office, and works?*

Thoughts on these lines naturally lead to the question of how best to discover just what faults do exist in a business and how the requisite steps might be taken to remedy them.

Finding the Faults

To do this constructively, ignoring trivialities and avoiding the choice of incorrect issues, involves not only appreciation of the functions of a business, but a certain state of mind. It is, in fact, by excelling in this latter sphere that the outstanding men of the business world have attained their prominence. A study of any one of these will quickly show that their outstanding ability lies in being able to analyse quickly and correctly even the most complicated position, and unerringly to place their finger on either the weak spot or the important issue, as the case may be. A certain leading industrialist is indeed so famed for this quality that not only would no supplier ever dream of attempting to 'pull a fast one' over him, but, more important still, his staff, knowing the uselessness of presenting a weak story for his consideration, has thus become more skilled in detecting the real cause of any weaknesses and consequently more efficient in the handling of the work of their particular section of the organization.

As organizing ability itself is primarily a question of ability to diagnose faults correctly, it naturally behoves all students of organization to concentrate on improving themselves in this direction. Failure to do so can have far-reaching effects. In factory management it can mean not only unsatisfactory organization as a whole or in any one department, but can also involve a company in completely unnecessary heavy financial expenditure.

Instances of this double type of evil are many and varied, but they can probably all be summed up in the experiences of a certain large woodworking factory engaged on the manufacture of household furniture products such as small cabinets, chairs, etc. Here the directors, aiming to produce in the best possible way and keen, therefore, to introduce the best possible labour-saving devices, decided to overcome their

material-handling problems by the introduction of a fairly considerable number of large power-driven conveyors. Orders for these were about to be placed, but before actually issuing them it was decided to seek an outside opinion as to the suitability of the respective types under review. To the amazement of the directors, however, and doubtless also to their relief, the consultant engaged for this purpose proceeded very quickly to prove that conveyors were entirely unnecessary, and, furthermore, that even better results than those expected from their use could be attained without any capital outlay whatsoever on plant equipment.

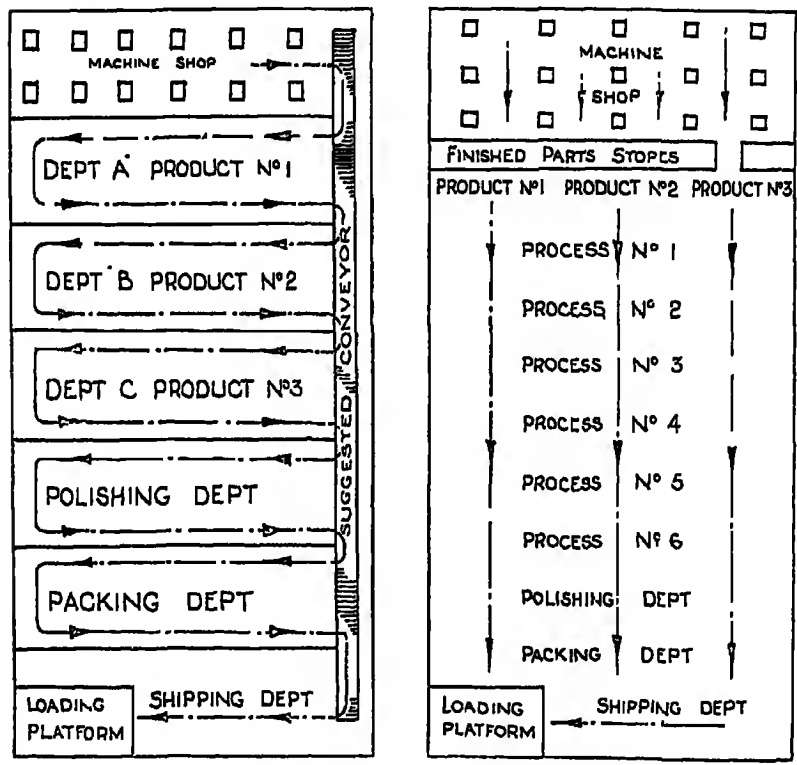
It was shown, for instance, that the original decision to use conveyors had arisen as the result of a completely wrong assessment of the main problems, as this was not one of material-handling but of lay-out. The fault was due to the very common failure of forgetting to take into consideration the special requirements of the products and the type of manufacture involved. Had this been done it would have been realized that the type of manufacture called not for the main advantages afforded by conveyor practice—*i.e.*, the transportation of goods over long distances or the rapid and continual flow of parts between two points over a set route—but for the gradual transference in easy stages down the factory of goods spread out over a very wide area in each department. The use of conveyors would not, in fact, have minimized the extent of material-handling, because their incorporation at any set points would have still involved an immense amount of handling in passing material and parts to and from the conveyors in each succeeding department.

No! The answer lay in a complete revision of the lay-out, so that by sectionalizing the work involved in the production—thus obtaining a number of processes of almost equal operation-time—it would then be comparatively simple to arrange operations in sequence, so that parts could be passed down the factory from the first to the final operation by normal transference methods of workers employed at their tasks, or, in other words, by the formation of the best type of conveyor for many sections of assembly work—*i.e.*, the human conveyor. That the company did decide to proceed on these lines has been an ever-constant source of satisfaction to them, because by so doing, not only was the cost of the conveyors saved, but, what is more important, the output of the factory rose rapidly from the moment the new methods were put into operation. Just how satisfactory this was is shown by the fact that although the increase of output at the end of the second month under the new system was exactly 45½ per cent, it continued to rise steadily, and at the end of the first year's working had reached a figure of 123 per-cent increase per week over the highest week's output ever attained under the old methods.

That so many concerns fail to assess faults correctly is in many cases the outcome of a process of wishful thinking. This is due to the fact that while most companies will at some time or other admit that their methods may be improved by the introduction of some modern system of progressing, production control, or costing, etc., few ever care even to consider that their methods of manufacture may be entirely

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wrong Indeed, often the suggestion that all is not well with a company's methods of manufacture is strongly repudiated by an indignant managing director, who, after citing his lifetime's experience in that particular manufacture, bluntly infers that if after such experience he doesn't know how to make the stuff—well, then, nobody does Whether or not, however, this disinclination to vet methods of manufacture be strong or passive, it is unfortunately a failing common to a wide range of concerns, which have yet to follow the example set by highly efficient enterprises that have



The Factory's Contemplated Use of Conveyors

The Revised Lay-out arranged on the 'Human-conveyor' Principle

FIG 1 A WOODWORKING FACTORY AND INCORRECT USE OF CONVEYORS

found profit in reviewing from time to time the efficiency of their manufacturing methods, and are for ever seeking new ways and means of improving and advancing their methods of production

Failure to recognize this necessity for seeking faults in actual manufacture as well as in other business functions often has a twofold effect on a company's general well-being, in that already high manufacturing costs are still further increased as additional staff are engaged to cope with imaginary difficulties elsewhere The creation of such a top-heavy organization, with overheads out of all proportion to a company's standing,

was, indeed, the experience of a company of electrical engineers, employing some 250 workers, which failed to appreciate that anything could possibly be wrong with the actual making of products that the company had manufactured more or less to the same design for some twenty years

This faulty theory would, however, have carried the company into bankruptcy had not the company's bankers, alarmed at the ever-increasing overdraft, despite the frequent reorganizations carried out, finally insisted on an independent investigation by industrial management consultants. This investigation proved that the company had tried almost everything except the main issue—*i.e.*, the improvement of its manufacturing methods. In so doing, it had built up tremendous purchasing, costing, and progressing staffs, and had duplicated—in some cases trebled—nearly every supervisory post until the total of indirect workers was actually far in excess of what any business, even with four times the number of productive workers, could possibly carry. Despite these multitudinous attempts at solution of the problem, it was discovered that no attempts had been made to introduce the one function most needed—*i.e.*, a planning department capable of introducing current practice into the machine- and fitting-shops. The reason for this, it was found, lay in the fact that the business was managed by two joint managing directors, one of whom, a very elderly man, although allowing his partner a free hand in so-called office matters, would not, however, countenance any interference with the manufacturing side of the business, in which section he retained absolute control.

Fortunately for the business, however, his semi-retirement coming at about this time made it possible for a start to be made on achieving the basic necessity of any business, which is the need to manufacture correctly. This took the form of the immediate introduction of a small efficient planning department, charged with the task of the complete revision of all manufacturing methods up to the recognized standards of accepted current practice. With this under way drastic cuts were then made in all supervisory and functional organization staffs to a level more in keeping with the size and activities of the business. The extent to which economies in this direction were possible represented no mean factor, as the total saving after allowing for the cost of the new planning staff amounted to a net gain of some thirteen thousand pounds per annum. Within some twelve months of the planning department's commencing operations it was, indeed, found necessary to re-engage a considerable proportion of this redundant staff in order to cope with the requirements of a rapidly expanding and flourishing business, which for the first time in its existence was producing economically and well.

Although it is true that instances of incorrect manufacture can often be found in even the largest and most modern plants, it is, however, in the medium and small concerns that this failing more widely exists. There are a number of reasons for this. Some are justifiable, as in the case of an inability to manufacture correctly through lack of capital to acquire modern machines and equipment, or the need to improvise

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for the manufacture of orders of small extent, or where repetition is hardly to be expected. Others, however, are definite faults—in most cases unknown faults that are easily curable. As a rule the latter exist as the result of a medium-sized or small factory's failure to apply to their manufacture the principles of time study, which prove so profitable in the larger concerns.

By this it is not implied that a small company should saddle itself with excessive overheads in the form of a self-contained time-study department, but that this function, in common with all the important functions practised by the large, efficient concern, should be catered for somewhere in the organization. To do this in a practical and economical way a small company may have to use a single individual to fulfil more than one function. Even so, however, the fact that a function is fulfilled, and not totally disregarded, will in itself bring forth results that will sooner or later allow a greater measure of specialization to be applied. Action on these lines would avoid the thousand and one faults in manufacturing, of which the following example is typical.

A medium to small company, highly dissatisfied with its machining costs on certain repetition work, sought advice as to ways and means of effecting an improvement on the machinability of the material, the tooling methods employed, or both. Investigation showed, however, that there was nothing wrong with the material or the tooling methods. What was wrong was that owing to complete absence of any appreciation of time study faulty drives to certain machines had been allowed to go long unrepaired, with the result that from some unknown date it had been necessary to reduce the speed of the machines to the level at which the drives could function.

One failure which is common to many factories, irrespective of their size or type of manufacture, is the firmly held belief that the solution of most of their problems lies in progressing. Indeed, in direct opposition to the truth of the matter—*i.e.*, that the more one controls production the less need there is to progress it—one often finds businesses with literally small armies of progress-chasers seemingly essentially engaged on pushing work through to completion. More surprising still is the fact that those businesses possessing practically every possible advantage for almost perfect production control at all stages are, indeed, the biggest offenders in this direction.

One would-be progress-minded company of this type was for ever introducing, and in turn discarding, one progress system after another until it was proved to them that progressing was in reality an almost negligible factor in their case, as the manufacture of a small number of products, each comprising few components, lent itself admirably to the best application of production flow, which in itself was the direct antithesis of progressing. Rearranged on a modified scale-adaptation of the line system of mass-production, the factory not only entirely dispensed with its hitherto ever-progressing need for still better progressing, but achieved at one stroke the aim which progressing had previously vainly sought—namely, the faster and more able handling of orders from the date of receipt to the ultimate dispatch. Under these conditions production control became not merely more simplified, but infinitely more positive,

not only in relation to orders in bulk, but in regard to control of individual orders throughout all stages of manufacture

Manufacturers are often misled in assessing faults, owing to a tendency to seek for improvement rather than elimination. The latter is essentially the first consideration, for it is by restriction of systems and methods, rather than by their improvement to a worth-while standard, that the best results are obtained. The best line of attack to employ is that used by professional investigators, whose first reaction to the value of any system or method is bound up in the thought, *Is this really necessary?* Viewed from such an angle, it is surprising how many systems, methods, or activities in the average business can be completely discarded. The scope open to such an application is obviously wide and varied, involving on the one hand small but nevertheless worth-while savings, or alternatively the total elimination of costly and ever-troublesome, important issues. It should be applied not only to questions of routine, system, and general organization, but with equal vigour to all phases of business activity, including design and actual manufacture.

An indication of just what this can mean to a company can be gathered from the following account of the experiences of an old-established engineering company, employing some 300 workers, which ran into considerable trouble as the result of failure to consider problems in this light. In its chief product this company used a most intricate hardened steel casting which had ever proved a source of trouble both from the point of view of difficult machining and the colossal amount of scrap produced in the process. With the advent, however, of a need for greatly increased quantities of this casting the company's troubles really began. The machining difficulties, which had been bearable while the quantities involved were comparatively small, now assumed most serious proportions. Likewise porosity of the castings, an uncertain feature often becoming evident only after much machining had been carried out, now also became an increasingly troublesome factor. So bad, in fact, did the position become that the company, faced with alarmingly high manufacturing costs, excessive tool charges due to a high rate of breakage, and a rate of production which was holding up many thousands of pounds' worth of orders for the complete products, detailed one man after another to concentrate on the problem to find some means of effecting an improvement. After some six months, however, of the most intensive concentration for improvement by way of better tooling methods, alternative processes, etc. no success had been achieved. The management, therefore, faced with a position which had now become intolerable, decided to submit the problem as a test-case to a business consultant to whom they had been recommended. This individual, a firm believer in "*why this system?*" proceeded immediately to ask himself the question, "*Is this part really necessary?*" and within exactly three days was able to prove to the management that by means of a slight modification to the general design of the product the casting could be completely dispensed with and be replaced by a very simple construction.

Which System or Method?

The correct answer to this question would, indeed, save much loss of time and expense in those businesses which unfortunately suffer from a preponderance of systems. More often than not the fault lies with one individual in the organization, who, having become suddenly 'system conscious,' appears to recognize in this a means of expressing a latent flair, and accordingly proceeds to 'regimentalize' the business to a set routine, governed and controlled entirely by the filling in and duly recording of a host of forms, slips, and papers. That these serve no real purpose and are filed away at some point in their life, never to be referred to again, does not concern this type of individual, whose main purpose has been served in that the prescribed information has been duly recorded. Usually it is some relative with a flair for organization who is allowed to express himself in this way. In one such type of business this eternal form-filling procedure had grown to such an extent that the staff became so preoccupied with it that they had very little time to spare to carry out the work for which they were primarily employed.

Most companies at some stage of their life suffer to some extent from this kind of thing. Even the best companies are not entirely free from it. Indeed a few years ago a world-famous organization had a similar spell, when it succumbed for a time to a charting craze which was then prevalent. Finally, however, the company was forced to take drastic action to limit the extent of this charting, as production was undoubtedly suffering as a result of too much attention being paid to recording progress instead of making it. Indeed, the real evil of too much paper-work exists not in the expense of the actual forms used—although this is often a very appreciable amount—but in the time taken by employees in recording the necessary information.

The golden rule for remedying excessive paper-work is to take one copy of each form used and plot these on paper in chart-form, showing the number of copies of each type used, the route taken by each, the information which each receiver obtains, and the use made of it. In bad cases the result will present a very obvious picture of sheer duplication of work, and the passing of all sorts of completely unnecessary information and irrelevant detail to the wrong people entirely. From this it is then a comparatively simple task to decide on the essential forms of advice and the maximum number of departments to which these should be directed.

Action on these lines will often bring forth really surprising results. Such was the case in a company employing a thousand hands, where it was found at once possible to dispense completely with some twenty-two different types of printed forms, which in view of the number of copies used amounted to some ninety-two pieces of paper. In a business whose activities and size of staff remain somewhat static over a long period such a review should serve for a considerable time. In the case, however, of growing and expanding organizations it is advisable to undertake this periodically,

to serve both as a check and also as a means of providing for adjustments required as the result of expansion

The business-man often fails to get the best out of his staff owing to a lack of exact knowledge as to just what each member actually does. This can be avoided, and the best use made of each, by adopting a similar method to that undertaken with regard to forms—in short, by the plotting of an organization chart, showing the exact duties of all important members of the staff and their relationship one to another. Some business-men may consider the use of organizational charts as bordering too much on theoretical fancy. Many have. Without fail, however, their outlook has undergone a marked change when the failings of their own organization have been brought to light by such a means. In one particular case the managing director of a fairly large engineering company was most determined in his total disregard for the value of such a method—until an organization chart of his own business was constructed. This made it at once evident either that he had by far too large a staff, or alternatively that no member was quite sure of what his duties really were, because the information on the chart showed that in a large number of cases the same duties were apparently being carried out from day to day by many different members of the staff. The investigation which followed did, in fact, prove that the staff were not misinterpreting their duties, but that excessive duplication of activities, born of the management's lack of knowledge of what each one did, was, in fact, the order of the day.

It is, indeed, in the existence of duplication of activities on a wide scale that the weakness of the large 'combine' often lies. Here failure to introduce centralization of activities for the branches as a whole—as, for instance, in purchasing—does not achieve unity of purpose, but, on the contrary, perpetuates the existence of considerable duplication in that each branch, despite the amalgamation, continues to operate largely as a separate unit.

To the average manufacturer in all trades other than, say, the heavy industries any consideration of what system or method to employ usually involves the question of the pros and cons of sectionalization. An outstanding topic and the subject of much controversy, it has both its many stern critics and its many whole-hearted advocates. No fast rule can be given as to where it should or should not be applied. This depends on many factors, not least of which is the degree with which the product lends itself to sectionalization. It can, however, be said that, apart from this fundamental question of the suitability of the product, sectionalizing primarily calls for the existence of reasonable manufacturing quantities. Where many manufacturers go astray is in the blind acceptance of the principle without due thought being given to these two very important factors.

Many small soft-goods manufacturers, for instance, have in the past run into all kinds of trouble as the result of attempting to work the sectionalizing system on products entirely unfitted for this method of manufacture. This has been especially noticeable in cases where the unsuitability of the product has been due to the fact that

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it was essentially of an artistic nature calling for no small measure of creative craftsmanship in its construction

In order to operate this method correctly, it is essential that the product permit of being 'broken down' into a number of self-contained units, each of which can be more easily and quickly manufactured than would be the case if the products were made one by one complete throughout. Involving, as this does, the use of specialized, and often inferior, labour, as against all-round highly skilled, it is essential that requisite steps be taken to safeguard the accuracy and quality of the separate parts produced in order that the final assembly of the complete product be one of progression rather than a major operation for the highly skilled worker.

The average non-engineering manufacturer can learn much in this direction by a study of the practices of leading engineering companies concerned with large-scale production, who, during war-time especially, have had to produce most complicated machines and mechanisms almost entirely by completely inexperienced labour. That they themselves learned much in the process is evident by the really astonishing results which have been forthcoming in so many directions. Indeed, there are so many examples that could be quoted of really remarkable innovations of sectionalizing in the engineering and allied trades during war-time that it is difficult to single out any really outstanding case for special mention. Probably, however, one of the best was the achievement of a well-known company of tool-makers, who even took large-scale sectionalizing into that hitherto holy of holies, the tool-room, and did it so successfully that practically the whole of the company's output of high-class tools was entirely produced by unskilled female labour. How they did it—and this is of importance to the engineering and non-engineering manufacturer alike—was not only by successfully breaking down the various products into self-contained units and processes, but, more important still, by making these processes as 'fool-proof' as possible.

The ensuring of as nearly fool-proof methods as possible is indeed very necessary to the successful running of any scheme of sectionalizing. So far as the non-engineering company is concerned it involves the establishment of methods whereby it is almost impossible for work to be done wrongly, or, if this be not a practical proposition—as, for instance, in the sewing trades—by infinitely more attention being given to cutting and inspection.

Herein, indeed, lies the chief reason why so many would-be sectionalizers in the soft-goods trade encounter so much trouble in the operation of this system. They are often completely puzzled why such and such a firm is successful while they themselves are not. The reason lies in the fact that they have attempted only half the story. They have, it is true, split up the manufacture of the product into sections capable of being produced by less skilled labour, but they have taken very few steps, if any, to ensure that these parts will be made accurately. Many are the cases where such lack of foresight has resulted in wholesale scrap being produced or, if the result is not so drastic, has involved so much rectification work on the part of skilled workers.

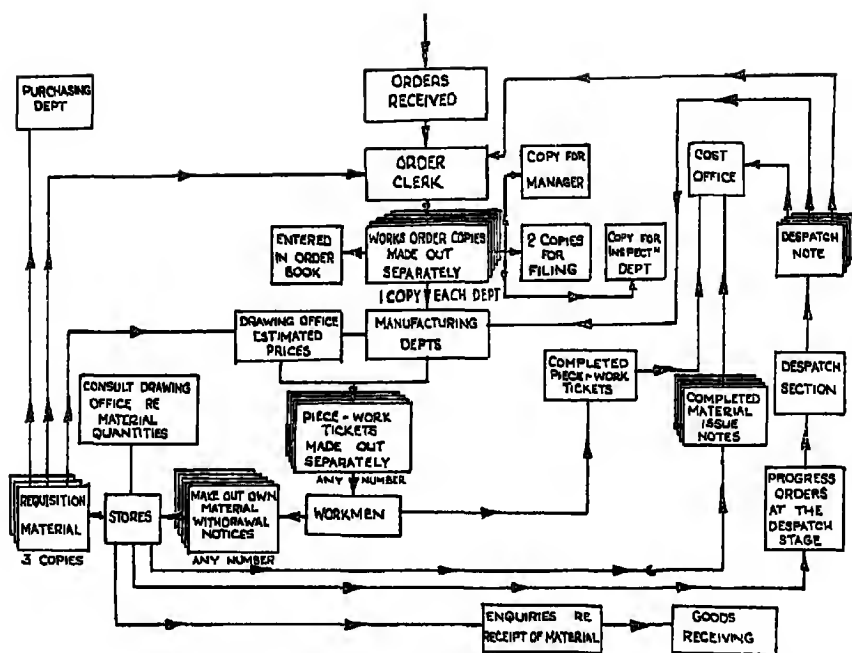


FIG 2 CHARTING PAPER-WORK A WORKS ORDER SYSTEM BEFORE REVISION

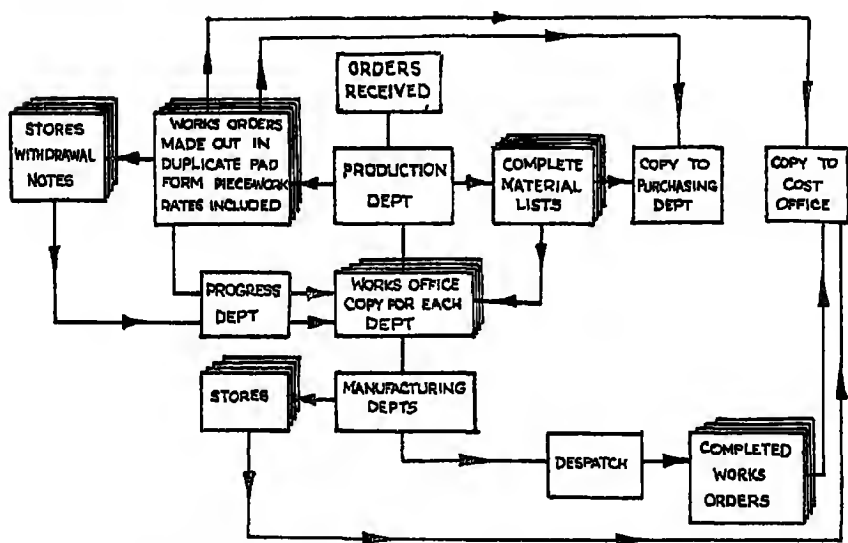


FIG 3 CHARTING PAPER-WORK A WORKS ORDER SYSTEM AFTER REVISION

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during final assembly that the main purpose of sectionalizing—*i.e.*, the faster and cheaper production of goods—has been defeated

One leather-goods manufacturer learned this lesson at very great cost. A large order for thousands of a certain type of leather case was duly sectionalized, and produced in the main by very cheap juvenile labour. When, however, the time came for the parts to be finally fitted together it was found that practically no two were alike. This involved so much scrapping and rectification work that the final manufacturing cost worked out at some 40 per cent. dearer than when skilled labour had previously made the cases complete throughout.

One factor generally overlooked by the introducer of sectionalizing methods, especially in small concerns employing entirely skilled labour, is the necessity to allow for an interim period while labour is being converted to the new methods or trained anew. This is necessary because it is, indeed, often more difficult to adjust skilled labour to sectionalized methods than it is to start afresh and educate entirely unskilled labour. Failure to so provide, and the change being introduced at the height of a boom season, has often had the effect of so retarding deliveries that, although some degree of sectionalizing has been achieved, this has only been obtained at the expense of a lost reputation for speedy and prompt delivery.

This question of the employment of the right type of labour for sectionalized work has been dealt with very thoroughly by the large concerns which employ unskilled labour in their thousands. Their case against the conversion of highly skilled labour is built up round the inability of this type of worker to adapt himself to drastically changed conditions on account of either prejudice or the inherent 'discretion' which appears to be promoted as the result of all-round craftsmanship. The experience on which this decision is based is similar to that of the large international engineering organization which came forcibly up against this problem when establishing two large plants in Europe. One of these, situated in South-east Europe, where labour was of the poorest possible type, did, however, produce records far surpassing anything obtainable from an identical plant, built at the same time in North-west Europe, where labour was largely drawn from the skilled workers already existing in the region. The position between these two plants was finally assessed as being the difference between the correct and incorrect use of labour. While the skilled worker at the northern plant considered it silly, for instance, to stand and paint the same type of part day after day, and reacted accordingly, the workers at the other plant, having had no previous industrial experience, accepted the chosen methods, completely undisturbed by any such reflections.

CHAPTER II

LOOKING AHEAD

MANY a manufacturer is so surrounded with problems that his greatest difficulty is often that of determining just how, when, and where to begin to tackle them and to bring reasonable order, as well as peace of mind, out of a very confused and disturbing picture. In this he is often further confused by an inability to distinguish between those troubles, if any, which are of his own direct making and those that are covered as a matter of course by the introduction of some degree of organization. All so placed, however, should take heart from two very definite and positive facts: firstly that problems are encountered in all types of businesses and that no one company suffers alone in this respect, and secondly that there is a right and proved way of tackling a position of this kind.

The best way, and, in fact, the only true way, of handling a position where problems are many and varied is deliberately to foster a policy of 'looking ahead'. An outlook of this kind serves a twofold purpose. Not only does it enable one to formulate a goal at which to aim—a vitally essential feature of any business—but it also clears the air of the immediate moment by showing the relative importance of existing problems to the chief and main issues of the future. Viewing matters in this way avoids, for instance, the dangerous evil of a company's being repeatedly stampeded by the supposedly most pressing problem of the moment, and makes room for the formulation of a long-term policy on which success for the future can be rightly built. The very existence of a long-term policy has its own special advantage, in that, by clearly defining the ultimate goal, it of a necessity places correct emphasis on the fundamental purposes of any manufacturing business—namely, to obtain work, to do it well and at the right price, and to dispatch it in accordance with customers' requirements.

It is not sufficient, however, for a company to classify its troubles as being simply of manufacturing, of sales, or of distribution. Broad classification, although useful in denoting where concentration must be paid, is not of itself conclusive. What is needed is an intimate knowledge not only of the actual faults occurring in any of these spheres, but, more important still, of how to put things right. It is in order partly to meet this need that the following sections of this chapter are devoted to a description of experiences in this direction in a wide range of manufacturing plants.

Reducing Manufacturing Costs

Though of paramount importance to any manufacturer, this issue is often obscured by lack of correct knowledge of actual costs or by a tendency always to place the blame

for excessive charges upon the efficiency obtainable from the actual manufacturing operations. Considering the former, it is surprising that, although true knowledge of any position is essential to the successful application of a remedy, many manufacturers are even to-day completely unaware of the true nature of their manufacturing costs. True, they make an assessment, but this is so much based on rule-of-thumb methods, and consequently often so wide of the mark, that many actually live in fear and trembling from one month to another, wondering how the year's balance-sheet will finally turn out. Under these conditions it is not surprising that important contracts are constantly won by competitors, or, alternatively, that a company appears able to obtain only orders for extremely difficult work, which, even with the small cost knowledge available, seems to offer only a very small margin of profit.

It is, indeed, often forgotten that there is a twofold disadvantage to inaccurate knowledge of manufacturing costs—namely, the losing of contracts due to the tendering of fanciful prices or, alternatively, the securing of orders at prices which cannot possibly be made to pay. Acceptance of much of the latter can naturally be a most serious affair. This was indeed the experience of a fairly large company of British accessory manufacturers. Here the introduction of a modern costing system proved conclusively that the company had for many years been misleading itself into the belief that it was able to produce, ship, and sell in the U.S.A. more cheaply than American companies could produce. The real position was, in fact, that so great a loss was being incurred on these American shipments that profits made in the home market were being to a large extent offset and that the general stability of the company was consequently being most seriously jeopardized. The company's turning-point dated from the moment American shipments ceased, as a result of true costs, and a concentration was made on home and colonial markets.

A cause of far greater loss to a company, however, is the tendency to place all the onus for high manufacturing costs on the performance of actual manufacturing operations. This is a most dangerous practice, tending to perpetuate poor organization and the existence of high overheads. In the factory a view-point of this kind means that while improvements to the extent of fractions of a penny are being sought from this or that machining process, pounds are being literally thrown away in numerous other directions. The most common of these and often, indeed, the greatest source of loss to the average company, is the totally unsatisfactory manner in which companies feed material and parts to the actual machine and bench operations, from which so high an efficiency is expected. A problem jointly of lay-out and of material-handling, it often accounts for a very large proportion of the all-round production times for any given process. The effect which the presence of such factors can have on manufacturing costs is clearly seen by the following example.

A light machine operation in an engineering works was one of many from which a decided increase in production was required. Expedients tried were mainly in the form of putting the operators on piece-work, then back again on day-work, on to

piece-work again under reduced rates—after which the operators were usually dismissed, and then the whole process started all over again. All this, as can be imagined, produced no other result than to provide a thoroughly disgruntled labour force. At last, in desperation, a time-study engineer was engaged and given this process as his first job. His analysis, taken in the first morning of his engagement, made evident both the fault and the solution. The operators, in machining the parts at an average speed of five seconds per piece, did, however, waste an average of fifteen seconds over each in walking several yards to and from a table to obtain the work-pieces and return the completed parts. With the placing of tables on both sides of each operator, close up against the machines, so that movement became completely unnecessary, either to pick up the work-pieces or dispose of the finished machined parts, the output from the machines was immediately increased by some 300 per cent.

Often the fault is closer to the machine itself, though not necessarily in the actual machining operations under consideration. A case of this type is taken from a wood-working factory which was encountering fierce competition on one very cut-price line. Here the fault of high manufacturing costs was considered as being due to laziness on the part of youthful labour in the "Mill" in failing to produce anything like the number of cut feet per hour that the machines were capable of producing. Investigations, however, proved that this was not the case. What was wrong was that the jigs and fixtures used to hold each piece of wood during cutting were of such an unwieldy and clumsy design that it frequently took ten times as long to fix a given part in the jig or fixture as it did to machine it.

The time required to place work in jigs and fixtures—usually referred to in engineering circles as manipulation time—is a consideration which, although most important, is often overlooked by those in search of lower production costs. That it exists in so many varied instances, although responsible for no mean portion of manufacturing costs, is due to the very common failing of simply viewing production times in the light of the time taken by a machine to perform actual cutting or working operations.

One great contributory cause of high manufacturing costs is to be found in the incorrect use of speeds and feeds. Old-fashioned general-engineering machine-shops are especially guilty of this. This failure to keep pace with current practice appears to be born of the belief that the use of up-to-date cutting-steels, the running of machines at speed, and, in fact, the aim of split-second production are only worth while where large-quantity production is involved. It would behove the managements of works where this idea is prevalent to begin at once upon the re-education of their machine-shop foremen and superintendents if the footsteps of others previously holding this view are not to be followed. The same fault, although due to a different reason—*i.e.*, the lack of mechanical knowledge—is to be found in many non-engineering factories also. Indeed, a comparison taken of three factories engaged in the upholstery trade proved that the most highly competitive of the three owed its success purely and simply to its ability to get the best out of its machinery.

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Any attempt, however, at improvement of manufacturing costs which is confined to the obtaining of better results in labour times is far from sufficient. To be really conclusive it must necessarily include that important and highly variable factor of overheads. It is very strange that, although one constantly hears manufacturers explaining that their troubles are due to the existence of high overheads, very little appears ever to be done about it. The common complaint that "the other fellow, of course, has much lower overheads," appears to be used in a sense suggesting his possession of extreme luck rather than good organization. True, there are often certain factors in overheads whose existence is not controllable by any measure of organization, good or bad—as, for instance, high rental charges—but, even so, the presence of high overheads is in the main the natural outcome of poor organization.

For all practical purposes, and, indeed, as far as the average manufacturer is concerned, overheads are largely a question of the ratio between direct workers and indirect. The effect that any appreciable variation in these percentages can have on selling prices is very noticeable, especially in highly competitive cheap-price lines. Here a cut of a few per cent in overheads can make all the difference between a margin of profit or loss.

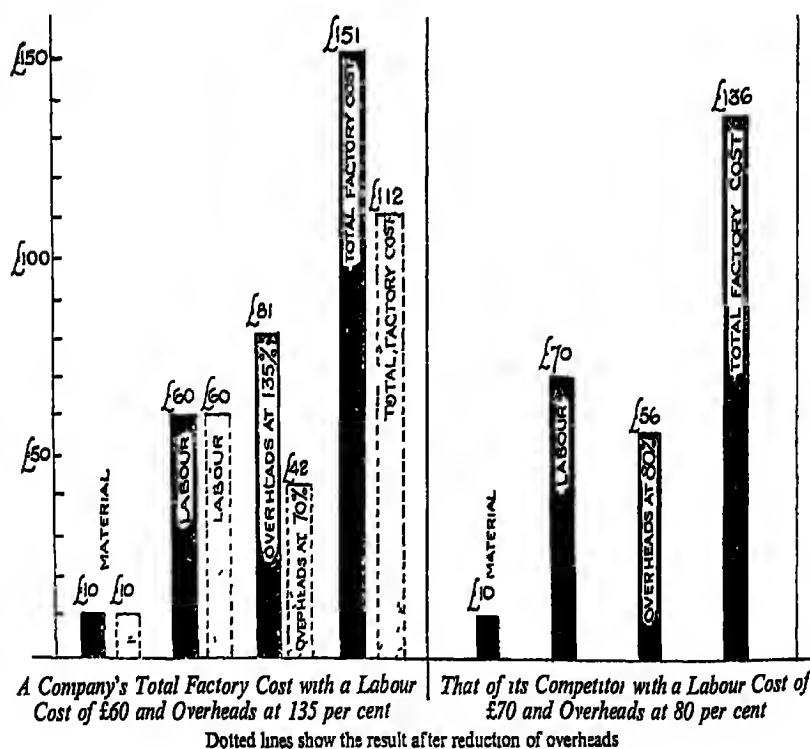


FIG 4 OVERHEADS IN PRACTICE

In a certain manufacture of this type a company's main product sold to the trade at 2s 4½d. At this price, however, orders were few, as competitors were placing equal articles on the market at 2s 3d each. Try as they would, however, the company with the higher selling price could not get down to the lower figure. Both material and labour costs had been reduced to the absolute minimum until no further reduction in price seemed possible. It was proved later that this was, in fact, true. The company's material and actual labour costs had been reduced to the lowest possible level and were indeed well below the corresponding figures of their competitors. Where the company had erred, however, was in failing to pay similar attention to their overheads. This neglect had allowed the growth of a top-heavy organization, with a very high rate of non-productive labour in proportion to productive labour, with the result that the company's overhead rate stood at 135 per cent as against the competitors' figures of 80 per cent.

Had the predominant factor in the product been one of material the variation between the two overheads might possibly have just accounted for the difference between the selling prices. The reverse being the case, however, and by far the greatest part of the total cost being made up of labour rates plus overheads, the excess overhead charge had a very appreciable effect on the final selling price. So much so that when, as a result of re-organization, it was found possible to reduce the company's overhead charge from 135 per cent to one of 70 per cent not only did the selling price become lower than all competitors, but the company also obtained a greater margin of profit than previously.

The conditions which had to be improved in order to achieve this reduction in overheads can well be noted, as these are indeed only too commonly found in many types and sizes of factories. At the first walk through the factory it became perfectly obvious that in the lay-out was the outstanding fault. A closer inspection revealed just how bad this really was. Although the factory functioned on one floor, the space had actually been sectioned into a number of small self-contained rooms, each fully enclosed by partitions stretching from floor to ceiling, and having its own entrance-door. Through these doors went an almost continuous procession of small girls, youths, and labourers, as they carried work-in-progress from one department to another.

In creating these self-contained departments, on the grounds that supervision could be stricter and the efficiency of each more accurately measured, the company had, in fact, produced the equivalent of a number of works within a works, each with its own special charge on overheads. This involved not only a large amount of indirect labour used in carrying goods to and from the various departments, but also a considerable duplication of supervisory staff. Indeed, the latter was most pronounced. Every department, including those which stood for the performance of most simple operations, had its own departmental head and assistant, and also its own self-contained inspection department. In addition to this a small progress staff spent its time in trying to persuade each departmental chief to put work through in the desired sequence. The latter had, indeed, proved a most troublesome feature

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because, although the manufacturing operations in all departments were carried out in a most able and efficient manner, great difficulty had been experienced in co-ordinating the activities of each to a set manufacturing programme

The action taken to alter this state of affairs, and to obtain the required reduction in overheads, consisted of entirely destroying the departmental principle of manufacture by clearing out the partitions and rearranging all processes in sequence order in one open department. By this means departments completely lost their identity, and became merged into one production-flow unit. Under this system labour previously used for transportation-work and progress became immediately redundant. Considerable reduction in numbers was also possible in the inspection staff, who henceforth were only needed at key points and not at each operation. Finally it was also possible to effect a considerable saving in supervisory staff personnel, owing to the fact that under the new lay-out the factory's entire labour force could be seen at a glance. Not least important of the advantages brought about by the new arrangement was the fact that, with hold-ups between processes being eliminated, much speedier deliveries soon became the order of the day.

That conditions of this type exist in so many factories is largely due to the fact that with insufficient attention being paid to this question of overheads anything other than essentially productive issues remains completely unnoticed. Many businessmen, in fact, could study the example just quoted and remain completely undisturbed, little realizing that even worse conditions prevail in their own establishment. One did, as a matter of fact, and, when questioned, explained that he could appreciate the point, but of course his works were not divided into a number of small self-contained departments. That was certainly true, as also was the fact that his company at that very moment was losing thousands of pounds per annum as a result of the infinitely worse conditions of lay-out existing in its plant. His was a state of affairs that had to be tackled eventually, and which, by the way, gave a prominent firm of lay-out specialists the biggest single job it had ever encountered in any similar-sized concern.

Securing Orders

A well-known company of factory organization consultants made a preliminary survey of a business which was rapidly declining for want of orders, and whose total personnel had, in fact, been reduced in two years from one of 1500 workers to approximately 250 on short time. Soon afterwards the chief partner of the firm of consultants met the company directors at a board meeting and made it perfectly clear that the first necessary step to ultimate recovery lay in the replacement of the company's sales manager. Aghast, the chairman of the directors pointed out that such a step could not possibly be agreed to, as the sales manager was, in fact, a relative of his, who most certainly had to have a job. The reply of the consultant was to the effect that it would pay the company to pension him off at a thousand pounds per annum. If, however, a job had to be found by all means provide one, but in a position where he could

do little harm, certainly something far removed from occupying the key post of the moment, where his complete ineptitude was, in fact, fast taking the business into bankruptcy

An even worse type of failing, and certainly more common than the case just quoted, is that where those responsible for sales direction console themselves that orders cannot be obtained because a demand for the goods just doesn't exist. These conditions, which are found in varying extents in many types of businesses, were very prominent indeed in a medium-sized engineering works connected with the shipbuilding trade. The attitude of the directors to a half-empty works was one of quiet resignation to the inevitable. The position, they contended, was due to no fault of theirs and, indeed, could not be remedied by any action on their part. The whole position, unsatisfactory as it may be, was, in fact, the natural outcome of a world-wide depression in the trade which the company served, and as such, must of necessity be borne with the quiet fortitude and understanding which would be accorded to any Act of God. That such a psychology was ill founded, both in substance and in fact, was borne out by the results of an investigation. Statistics thus gathered proved that, although a depression certainly existed in shipbuilding circles and far fewer ships were being built than in normal times, the fact remained that the company was not obtaining any orders for those that *were* being built.

Often the unsatisfactory obtainment of orders is due to the employment of the wrong type of representative. This frequently is the case with regard to overseas markets. Here, for some unknown reason, many companies, including even those of standing and repute, seem content to leave their representation in the hands of inexperienced, non-technical, and non-practical young men. Although they are usually of excellent type, capable of gaining entry into the best circles, their complete lack of knowledge of the products they are expected to sell proves a handicap which no social advantages can possibly offset. Indeed, so overridingly damaging does this lack of even elementary knowledge often prove that it is frequently due to this alone that so many companies fail to achieve anything like the amount of overseas trade to which they are entitled. To see a man of this type in the Far East, for instance, attempting to compete with a fully qualified high-pressure American salesman is both pitiful and ludicrous. It is certainly not the fault of the representatives but the people who send them out so obviously unqualified.

Many British companies would do well to study American salesmanship. The training of a representative in America involves not only going through the shops and receiving practical and technical training on the products which he will at some future date be called upon to sell, but also information about the weaknesses of competitors' models. The slightest attempt at training on these lines would, for instance, have saved a company of paint manufacturers from losing the entire market in one Eastern country—a position which arose as the result of the inability of its representative to deal on the spot with questions of humidity as affecting certain types of stoving enamels.

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At home the problem of securing orders should undoubtedly be eased to many as a result of the experience gained during war-time in the carrying out of contracts on a sub-contract basis. Rightly handled the contacts thus made should lead to equal, if not greater, association between the large and small concerns, as was occasioned by the demands of a country at war. Indeed, there is no reason why the sub-contracting principle, which in itself was in no small measure responsible for the country's rapid and extensive production of arms, should not be applied with equal effect to meet the requirements of peace-time needs. Its continuance would indeed be welcomed by many large organizations, who, during six years of war, learned to appreciate the advantages of delegating responsibility on a large scale.

One decided advantage which the small firms have gained from participating in war-time organization of sub-contracting has been the added confidence which their staffs have derived as a result of close dealings with the technicians and staffs of companies of world-wide repute. This should stand many in good stead. Indeed, with this added knowledge and experience many small concerns should be able not only to attract more business, through being able to produce their own peace-time products more efficiently, but should also have all the necessary confidence to venture into entirely new fields as and when the occasion arises. That this need be in no way limited is clearly shown by the success with which so many companies, used to products completely divorced from engineering, broke into this latter field from the year 1939 onward.

Even those companies with well-established peace-time products, and therefore without the need for undertaking sub-contract work as a means of livelihood, may find it advantageous to augment their peace-time turnover by allowing their maintenance departments and tool-rooms, for instance, to continue to undertake a certain percentage of sub-contract work. It is, however, necessary for all types of concerns, whether employed on sub-contract work or on the production of complete products, to realize that the predominant factor in the securing of orders in peace-time is that of quality at a price. There should be no illusion about this. Many companies who prospered in war-time did so purely and simply because the demand for goods was so pressing that to many circles it came to mean "production at any price." Although this led to the practice of many abuses, the high prices charged by many was as a rule not so much wilful as due to the existence of sheer bad estimating and/or poor production methods. In peace-time the existence of either of these evils has no other result than that of bringing about a decided limitation of orders.

Herein lies a most important point. Many manufacturers faced with a dropping off of orders, and especially the sudden termination of repeat orders for contracts normally theirs, fail to appreciate that more often than not the non-renewal of long-held contracts is due entirely to the question of price. In reasoning that the price must be right or they would not have secured the work in the first place, the manufacturer does not allow for the fact that the customer's original buying may have been faulty, or that normal progress should make possible a periodical improvement in price.

It is in this latter sphere that the best-organized companies are the most exacting with their suppliers. Continually succeeding in obtaining cost-reduction in their own works, they naturally expect their suppliers to do likewise, and consequently to produce tangible evidence of this periodically in the form of a reduction in the price of the articles supplied. Indeed, in many of the large organizations it is part of the management policy for purchasing prices to be keenly vetted every few months. For a buyer to hold down his job, therefore, he must be able to show occasional improvement in the prices of the goods which he is responsible for obtaining. Unfortunately for the supplier, the attitude of the purchaser in this matter often does not become apparent until either it is too late or an immediate big reduction in price is expected in one cut. That the latter can have most drastic effects in a company where high prices are the result of inefficiency and not excessive margin of profit has been the experience of many. In those cases where the company involved has been one supplying a single product entirely to one concern it has usually meant going out of business, because few firms can overcome inefficiency quickly enough to be able to bear the immediate price-reduction.

Where efficiency exists in a business, however, the securing of orders, although requiring, of course, requisite sales organization, can nevertheless be looked forward to with complete confidence. Markets of all kinds, whether represented by the large purchasing organization or the general public direct, are not only quick to appreciate efficient service, but are indeed for ever searching for sources of this kind. It is in order to be ready to meet this fast-growing demand that it is imperative that British Industry—comprising the highest and the lowest, the large enterprises and the most humble back-street firms—should start now, and continue ever to seek the utmost possible efficiency from each and every activity which forms part of its business enterprise.

Delivering to Time

Many manufacturers who are for ever being continually pressed from all sides for delivery are apt to forget that success in industry depends not only on price and quality of the goods supplied, but also on the degree of service afforded to customers.

The reaction to being continually behind on delivery varies according to the type of person concerned. Often it is one of complete indifference to this important point, in other cases it consists of cursing at badly over-worked and harassed departmental heads, while in many cases it consists of continually juggling with all orders, starting and stopping one after another according to the most vehement complaint of the moment. Very seldom, however, is the position analysed, the real cause of the trouble ascertained, and steps taken to put matters right. Failure to do this reacts sooner or later to a company's disadvantage by incurring, in the first instance, a reputation for poor service—a consequence which is usually the forerunner of much more serious ones.

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Worse than this, however, is the fact that a company continually faced with delivery problems and complaints cannot possibly be turning out its rightful measure of turnover. This is true even where the fault is due entirely to a company's accepting more orders than it can possibly cope with. In these circumstances attempts to do the impossible, and satisfy a range of customers whose total orders for delivery in any one period is far in excess of the capacity of the plant, has no other effect than to bring down the output of the plant to a figure well below its capacity. The longer this policy is pursued, the worse, indeed, does the position become. In fact, in many cases, it involves so much chopping and changing and breaking down of production, as first one order and then another is given preference, that conditions rapidly deteriorate to one of chaos.

Conditions of this kind are by no means of an isolated nature. Usually, however, the position is infinitely more acute in the case of a factory dealing with a goodly variety of products or a large number of types and sizes of a single article. It was in a medium-sized factory of the latter kind that this question of delivery became so bad that something just had to be done about it. The factory, employing some 800 workers, was engaged in producing various types and sizes of an article which is used wherever there is a need for things mechanical. With a reputation gained for the quality and performance of its products, the company proceeded to accept order after order without giving the slightest consideration to the maximum capacity of its plant or its all-round facilities to handle such a volume of business. Consequently the time arrived when it became impossible to cope with the mass of orders on hand. Inside the factory itself at this time chaos did indeed reign. Around practically every machine lay stacks of work piled in boxes, waiting its turn for the various processes. Much of this work, representing a great number of individual customers' orders, was in various stages of completion as a result of orders being continually stopped during manufacture to make way for the most pressing one of the moment. As established priority very seldom lasted throughout the length of one day, and, indeed, was often changed hourly, production became such an intermittent affair, that the general position deteriorated still further as a result of a considerably reduced output. Strange to say the move taken to counter this falling output consisted of still further applying the priority system by marking orders urgent, very urgent, extremely urgent, and so on. This was persisted in, despite the fact that it became uncommon to encounter an order not marked urgent, or the like, and that it was obvious that the people in charge of production were hopelessly confused and found it almost as big a task to unravel the priority rating as to make the actual parts. True, the occasional granting of extraordinary priority on certain special orders, did see these rushed through to completion, but even this result was only obtained at the expense of still further retarding the rest of the orders in the factory.

The first move taken to right this position was that necessary in any business—namely, the determination of the total capacity of the plant. This done the figures

were then compared with the required output per month necessary to meet customers' requirements and reasonably cope with the volume of work on hand. A most unsatisfactory picture was the result. It became immediately obvious, for instance, that the company was at that very moment accepting orders to promised delivery dates which there was no possible hope of meeting. Indeed, promises of delivery had arrived at the stage of simply being a meaningless gesture, because in practice the time taken to complete any given order was usually several times longer than that quoted. As this position could not be allowed to continue, it became necessary to secure at the earliest possible moment some limitation of the extent of the orders on hand so that pressure could be temporarily eased, and thus some form of control to regulate the handling of orders might be introduced.

The method chosen was the immediate sub-letting of a considerable portion of the orders in the company's books. This particularly applied to new orders, leaving the factory to concentrate on cleaning up work in progress. This clear-cut reduction in the number of orders in hand left an amount of work which the capacity of the plant could cope with in reasonable time, and without any appreciable interference with the continuity of production.

The control then introduced was aimed at two definite results: firstly the acceptance of orders to delivery dates within the company's power to maintain, and secondly the control of their sequence of manufacture to the prescribed delivery dates. In other words, it meant the providing of some means whereby machines could be accurately loaded, not only in extent but in desired sequence, and that this information should be available to the estimating department in order that accurate delivery promises could be made against each inquiry received. As component parts were comparatively few in number this was accomplished by the use of an adaptation of the Gantt Chart principle. To ensure its correct operation a small production control section was formed. This department, after deciding the sequence in which orders were to be manufactured, loaded each machine by recording on the chart the finishing times by which each order could be expected from the various machines. By this means, not only was a manufacturing programme set, but in addition it was ensured that no single machine was under- or over-loaded.

The estimating department and each manufacturing head were furnished with a copy of the master charts. These were maintained and kept up to date by the production-control department, who adjusted the charts as new orders were received and old ones completed. Once established, it meant that any given foreman or charge-hand could see at a glance what orders were actually being produced on each machine, the different times by which each ought to be completed, the next order to follow, and finally just how far ahead were orders booked against each machine.

On receipt of an inquiry the estimating department, being aware of the operations involved in any product and the piece-work times for each, could immediately see from the charts the earliest possible moment the order could be put into production.

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and the time by which it could be completed. With this information to hand it was, therefore, in a position to offer accurate delivery promises against all inquiries. When the order was obtained the production-control department planned the sequence of its manufacture in the same manner, and duly recorded the necessary information on all charts. Manufacture being undertaken in the specified sequence, orders were always completed according to schedule.

Until this procedure became firmly established, however, snags did arise as the result of the estimated times not being fully borne out in practice. That it proved possible quickly to overcome this and a number of other faults was due to the added efficiency which was speedily forthcoming from the shops in consequence of the higher measure of continuity of production. Indeed, within a very short time the output of the factory had so increased that it was possible entirely to discontinue sub-letting any further orders. This improvement continued month by month, until at the end of twelve months not only had the factory won a golden reputation for prompt and efficient service, but the production had increased by something like two and a quarter times.⁶

Apropos of this, it is important to note that where many factories go astray is that after rightly assessing their need, say, for production control they try to operate it by the use of systems far too elaborate and complicated for their particular requirements. Many a medium-sized factory, for instance, uses a type of 'Colourdex Control' system for regulating material and production flow, when their needs could best be met by much more simple means.

It is not possible to specify any particular system for a given size of factory, as suitability is governed by the complexity of the product, quantities to be handled, and many such factors. The chosen system may therefore be one of several methods, such as by Gantt chart, control board, Colourdex, schedules, etc., each of which have their own particular uses.

Where a fairly large factory is concerned, especially where the product is complex and involves many component parts, control of production flow is often best handled by using joint methods. In this case charts or control boards are used in a central control office to give an overall picture and for regulating the flow of raw material and sequence flow of orders throughout manufacture, from the day of receipt to the ultimate dispatch, leaving the issuing of the necessary instructions to the works to be given in the form of schedules. In general, however, the best system is that which provides for the essential features in the most simple manner, is easy of adjustment, involves the minimum of clerical work, and presents the facts in clear unmistakable form.

Although delivering to time is largely controlled by the speed with which orders can be routed through a factory from one manufacturing operation to another, success is not entirely ensured by efficiency in this direction alone. To be really effective delivering to time calls for a state of good, all-round organization throughout the entire business. Particularly does this apply in those departments which, next to

manufacturing, have such an important bearing on the subject. Pre-eminent in this direction is the question of the rightful handling of goods during and after manufacture.

It was due to a late realization of the importance of both of these factors that a large organization, with an immense spares service, applied the same principles to its stores and dispatch departments as were used on actual manufacture. This organization, producing large quantities of an article in great demand, had, however, an even greater, and certainly more profitable, spares trade, in which it prided itself on being

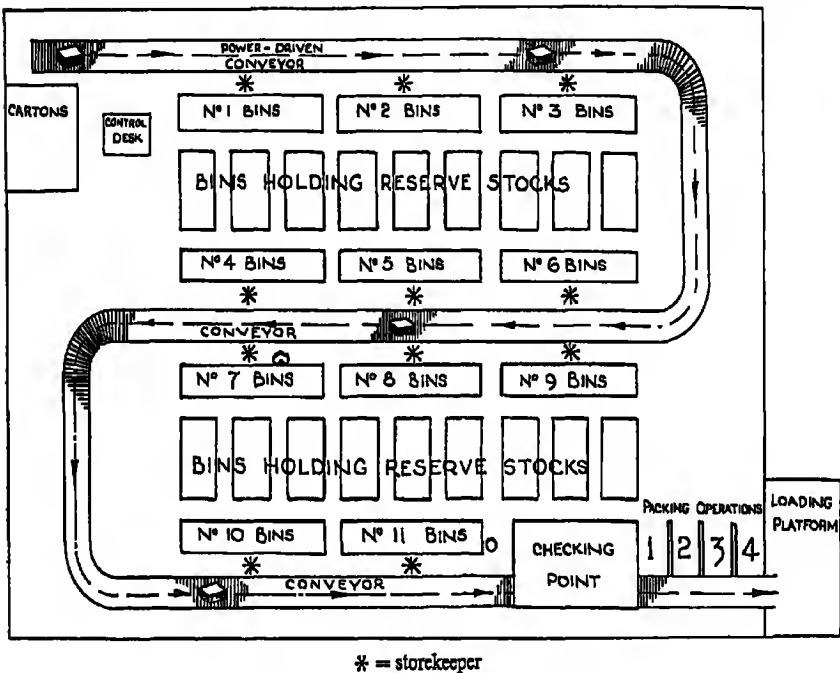


FIG 5 CONVEYOR PRACTICE IN A LARGE STORES AND DISPATCH SECTION

able to render a twenty-four-hours' service. In practice, however, this was not borne out, and it was with a view to attaining this that researches were made to locate the cause of the trouble. Eventually this was tracked down to the fact that although orders were being handled with all possible speed on the manufacturing side, this was to no small extent being offset by the slowness with which the same orders were being dealt with in the stores and dispatch departments. The main source of trouble lay in the fact that, whereas throughout the manufacturing side materials and the product itself were being handled by conveyors, the gathering together and actual dispatching of orders was still a man handling affair.

The claim to the holding of a twenty-four-hours' service was, indeed, more than borne out when, as a result of this finding, collection and dispatch of orders was facilitated by the installation of power-driven conveyors throughout the stores and dispatch

departments This took the form of running the conveyors in a continuous, winding line throughout the various lines of stores bins, direct to the dispatch department By this means handling of goods became largely automatic An order started at the beginning of the line by placing in a suitable container on the conveyor all the documents relative to the order The order, passing down the conveyor, grew in its travels as storekeepers stationed at various points added the quota of parts in their charge which were called for on the order before passing it on down the conveyor to the next store-keeper, and on to the dispatch department In the dispatch section final packing operations were arranged in sequence on the end of the same conveyor, so that an order issuing from the stores in its complete state was packed, tied, and labelled at certain predetermined intervals on the conveyor, until arrival at the end found it ready for dispatch and loading on to incoming transport vehicles

Although such methods are obviously only practicable in the large company handling great quantities of work, it is important to note that the principle stands good for application in the medium and small concern Inability to use conveyors, for instance, should not be interpreted as meaning that complete lack of order and system can be tolerated This indeed, was the position in a medium-sized works, employing some 600 workers, faced with the same kind of trouble Here manufacture, being on a much smaller scale and, therefore, in no way highly mechanized, was nevertheless carried out in a most highly efficient manner for its type Inability to deliver to time was, however, a distinct failing This was due to no fault of any production arrangement, but was the outcome of inefficient stores and dispatch methods, which caused hold-ups to delivery, through slowness in supplying workers with parts and material during manufacture, as well as in the final packing and dispatching operations Although the latter was important, the chief evil lay in the delays which constantly occurred in the issuing of goods to workers during manufacture Surprisingly enough this remained unnoticed, although completely obvious, as in so many companies, by the gang of workers ever to be found around the stores-window awaiting issue of parts or material

When conditions in the stores itself were vetted it was found that the trouble lay in the fact that the same small body of workers were responsible for receiving incoming material, serving the window, and the final packing and dispatching of a very large export trade That they fluctuated from one task to another, and in reality performed very little of each, was the sole reason why the company experienced difficulty in delivering to time

The dividing of functions and duties provided the solution The stores were rearranged to provide for different sections for receiving, issuing, and packing, with separate groups of workers detailed specifically to each This proved so successful that the difficulty of not being able to deliver to time was soon swept away on account of the rise in output which resulted from this alteration

CHAPTER III

A STITCH IN TIME

UNFORTUNATELY for British industry as a whole too many businesses, large, small, and medium-sized concerns alike, consider organization, if it be considered at all, as a necessary evil only to be undertaken in time of acute peril. Failing to appreciate that a "stitch in time" is not only a sound maxim but the life-blood of all true progress, they put off from day to day those very necessary steps which, if taken from time to time, not only ensure advancement but, indeed, build up the stability of a company to withstand the testing times which sooner or later come to all. That many so act is responsible, indeed, for the existence of such a large number of struggling businesses, and the fact that times of depression find so many completely unable to weather the storm.

Investigations made in a number of these latter companies at such times have proved most illuminating. From the facts and figures thus derived it has been evident in every case that the approach to insolvency had been brought about by a failure to take requisite steps in the past, and not, as some companies would suggest, as the result of a kind of Act of God, which has hit them but spared their competitors. Indeed, the reverse has often been the case. Comparisons made at such times between a failing company and a number of its competitors has repeatedly proved that the latter have had to overcome greater obstacles with far less advantages than the unsuccessful company.

From a number of such comparisons taken in a variety of trades it has been proved conclusively that lack of large capital resources has not been a bar to weathering difficult times. The sole winning factor has been the possession of a reasonable degree of efficiency. This has made itself felt in many different ways, not least of which has been the ability to keep manufacturing costs at a reasonable level, and to produce that little extra in quality and performance of products.

The apt saying that "goods of quality will always find a market" is certainly more true in times of limited demand, when the tendency is to pick and choose, than in prosperous days, when the accent is on supply.

In days of acute depression the banks frequently find it necessary to engage specialists to investigate businesses and endeavour to pull them round. Almost without fail such attempts are successful, and concerns which have fallen to a very low ebb are saved and gradually built up into sound economic propositions. That this is accomplished often under the most extreme of adverse conditions is proof not only that neglect was the original cause of the failure, but also of the value of the timely action

But it goes further. It proves, for instance, just what is possible when the "stitch in time" is applied as and when required. This opens up unlimited scope for the ambitious company in and through the fact that with uphill struggles avoided concentration on improvement becomes a steady routine task in contrast to a fight for actual survival.

Recognizing the Need

That many fail to recognize the need for timely action is in many cases due to the holding of a very superficial knowledge of the work carried out in any given department. This, more often than not, results in an exaggerated view being obtained of the efficiency which actually exists.

It was by the proving of this point by chance to a managing director of a medium to large engineering works that led to his having the entire business investigated. The manner in which it occurred was most unusual. A case being put to the managing director for the need for improved organization was countered most decisively by the claim that first-class methods and up-to-date organization already existed in his business. Questioned on this point, he unhesitatingly named the company's drawing-office as a shining example of such organization, and to press home the point produced a drawing to illustrate the efficient work which was the everyday practice of the draughtsmen. To his consternation, however, it was very quickly shown that the drawing, far from being efficient, was, in fact, about the worst example of inefficient draughtsmanship ever encountered. The reasons were obvious. On the drawing were two views of a very complicated mechanism which at first sight appeared absolutely identical. Closer examination, however, revealed that there was a slight difference. This occurred in the length of a certain "boss," which in the second view was shown to be a slightly different measurement. Instead, therefore, of the drawing-office producing one view and adding a note to the effect that for product *B* three-quarters of an inch should be added to the length of the boss marked *X* and that the boring should be to a given larger size, it had taken a further four days to reproduce entirely a completely unnecessary view.

To ignore the need for periodic improvement in a business is to live in a fool's paradise. It is akin to the man who, for health reasons, was continually being advised to leave the tropics once and for all and return home, but, begrudging the lowering of social position which this would involve, he kept putting off the evil day—and in the end delayed the matter too long.

It was largely on account of this hesitancy to take action at appropriate times that there were so many outstanding war-time failures. In these cases the need to determine and reach decisions on major issues was so shelved by some managements from month to month and year after year that very little short of complete rebuilding would have made possible a solid foundation on which to work. Even the com-

paratively successful businesses were guilty of repeated minor instances of this kind of thing. Only too often was really bad organization, which had accrued as the result of neglect, permitted to be glossed over by demands for more machine-tools and labour. On the other hand, the outstanding production successes of the war undoubtedly owed their eminence to the thoroughness with which they originally planned, and continued to plan, in a never-failing pursuit of still greater production and lower manufacturing costs.

It is appropriate at this point to consider some aspects of the stitch-in-time policy pursued by a company which proved an outstanding production success during the war. The scheme was sound, largely as a result of the wise moves taken at the beginning. Right from the moment of its inception planning became not so much a matter of deciding on machine-tools and rushing up buildings, as the predetermination of the special difficulties which would confront such a scheme in war-time and the deciding of the priority sequence in which these should be catered for. Chief of these was the correct forecast that, as the labour which would eventually be supplied would be largely unskilled, key workers were required not only to man important posts but to train others. This led to the undertaking of one of the earliest moves—namely, the establishment of a labour-training school, wherein male and female dillutees received training long before production was even contemplated. True, many other companies also formed training schools, but with this difference, that they were often far too late, with the result that production, when it was in due course started, developed only at the rate with which workers attained proficiency. The prior training of workers for specific jobs is one which the average company can well incorporate as a permanent feature of its organization.

A further important move taken at the commencement of the scheme under review was the outcome of a realization that, as the production of an entirely new product was to be undertaken, every one connected with the scheme would have much to learn about its design and operation. This led to the provisioning of the utmost possible information about the product, which was then passed on to departmental heads and all key workers to whom such information would be of advantage.

This is a practice which would pay handsome dividends in many companies if applied to their everyday product in normal times. Only too often are costly mistakes made, even by senior men, through an insufficient knowledge of the product being made. It should not be considered that long service is any criterion of the possession of knowledge, on the contrary, with modern progress as it is, this is often a handicap. The furnishing of information, however, achieves probably even greater service in that it stimulates interest, and ultimately pride, in the standard of the company's products. In this connexion it is of interest to recall that a certain world-famous engineering company, with a name known to every household, achieved its reputation for quality in no small measure as the result of the pride of its workers in the article produced.

Of special importance to the ultimate success of this war-time scheme was a decision, taken in the early days, to train fitting and assembly workers well in advance of production requirements. This was accomplished by sending a nucleus of each for training to other works where the product was already being produced. The outstanding advantage of such a policy was that not only were these fully trained when withdrawn at a later date to begin the company's own production, but in addition they came away with an outlook immeasurably improved by knowledge of the other fellow's methods.

Herein lies an important reason why so many companies are not progressive. True, in normal times a company cannot send its work-people for training to competitors, but any company can, in fact, apply this principle in another way, by making it possible for staffs to be able to visit suppliers more easily. Many do, and for the express purpose that by this contact, through gaining knowledge of other methods, and by discussing problems on the spot their staffs are kept up to date, and consequently more able to assimilate any improvements which modern progress may offer from time to time.

That the company secured a reputation for first-class purchasing activities in such difficult times was due to the very special attention accorded to all sub-contractors and suppliers. This arose through the recognition of the fact that the weakest part of the entire scheme lay not in their own works but in the works of the weakest sub-contractor.

Inefficient purchasing is the general rule in Great Britain. By this is not only meant the actual buying but more especially the policy relating thereto. Companies, for instance, are frequently to be found manufacturing all parts of a given product, when many of these parts are completely ill-suited to the existing facilities, and, moreover, are of a specialized nature which should be sub-let.

One of the good moves of this war-time scheme arose when the company ran into trouble. It was at a stage when the commencement and subsequent growth of production was more or less dependent upon machine-tools arriving to schedule. As this did not always happen the company decided to limit the extent of the trouble by embarking on a policy of temporary improvisation. This proved so successful that it was possible to commence production at the desired date and to maintain a rising output despite the non-receipt of a considerable number of specialized machine-tools.

It has been said that improvisation is the enemy of organization. This is far from correct. Organization, to be good, must be flexible and capable of meeting and overcoming any set of conditions that might arise.

Last, but by no means least, the successful running of this war-time scheme, from the day of its inception to the time when it had broken all records, was in no small way due to the management's policy of fixing targets. These targets were applied not only to set the aim for production month by month, but to cover the pace of

all manner of activities having an important bearing on the main issue of production. One of the earliest, for instance, was that which set the latest date by which the first building had to be ready for occupation. In course of time others came into being, which, for example, fixed the time by which the tool design programme had to be completed, or the date by which a given number of sets of material had to be in the plant. The most important target, however, was that concerned with actual production. This target drawn up in the very early days of the scheme, long before buildings were erected, set the date by which delivery of the first product was required, the date by which full production had to be reached, and the desired rate of production month by month between these two dates.

That the company never once failed to attain the ambitious targets that were set, and that in so doing they broke all records, was indeed an astonishing achievement. That it was made possible was not by good planning alone, but probably more especially by the zest for attainment which such targets produced. Indeed, by the whole staff, from the highest to the lowest members, the month's target came to be looked upon as the 'bible,' which just had to be lived up to in the fullest possible sense. This ready acceptance and spirit of do or die, so obvious in even the most humble charge-hand, was a perfect tribute to the psychological understanding with which the scheme had been devised, accurately constructed, and eventually introduced to the workers.

Important to note is the fact that this target-setting system was by no means an innovation of the company to meet war-time needs. It was, indeed, a regular peace-time practice of the company, and had been used with outstanding success for many years.

Harassed directors in those companies where it never seems possible to achieve anything like good production results would do well to adopt this practice to their needs. One very big advantage which would accrue from this would be that all connected with production would be welded closer together in a very intimate relationship.

For this practice to operate and function correctly, however, target figures have to be very correctly set. This in itself is a blessing, in that the managements who operate it have, therefore, to be in full possession of all relative facts. Herein lies the crux of the question. No company can hope to organize successfully, either as a whole or in a single section, without directors or managements, as the case may be, being thoroughly aware of all the facts of the case. If this applies to the founding of basic organization, it certainly applies even more to the task of instituting periodic improvement as time rolls by.

The wise director is one who calls for periodic reports on subjects which will enable him to be always in a position to correctly assess the efficiency of the business as a whole, or of certain leading functions. The managing director of one very efficient organization handles the matter by calling for daily, weekly, and monthly statements on a variety of matters relative to output and cost of production. These include

a daily statement of the output for the previous day, a monthly one on costs, a weekly return on complaints received from customers, and a weekly statement showing the engagement and termination of labour for the previous week. In calling for the latter, which includes a break-down of the total labour force, he is able not only to keep check on the ratio of indirect labour to direct, but is also in a position to watch and safeguard the interests of all employees, thus preventing victimization or irregular working time.

The application of timely action to secure improvement affects matters other than the efficiency of the works, office, or business as a whole. To be really comprehensive it should be equally applied to the product itself. In many cases this concerns not merely improvement of design or performance, but the entire suitability of the product to stay on the market with a reasonable chance of selling.

Many times in the past companies have suffered heavily as a result of staying on the market too long with a product which has outlived its saleability. Wise concerns not only review periodically market prospects for their existing products, but are also continually on the look-out for favourable new or additional lines.

Countless instances could be quoted of companies in all manner of trades which have chosen the right moment to cash in on some new development or to obtain manufacturing licences for some foreign invention. Luck plays little part. In the main it is the outcome of applying a policy of "prevention is better than cure" to a business as in the case of an individual.

The years immediately ahead offer unlimited scope to the enterprising. Sound organization is, however, absolutely essential. Enterprise may make possible an opportunity, but results are forthcoming only from the organization applied to it. Industrial history is full of the graveyards of the companies which were enterprising enough to be the first to break into fields of new development but lacked the necessary organization to pull them through.

Choosing the Hour

Few men attain positions of great prominence without having acquired the habit of occasionally utilizing leisure moments to sit down and take stock of themselves and of the progress made over a period. The greatest and wisest industrialist known to the author is a man who continually does this and spends some portion of most evenings in an armchair in his study for this very purpose. That he and others like him are able to grasp opportunities by so doing is as certain as anything can be. Far from indulging in idly dreaming, they take stock of faults and failings and of experience gained, and by this very reasoning are able to concentrate on the future and decide the date, if not the hour, by which certain attainments must be reached. Business life is often at fault for want of a little of this calculating reasoning. How often does one hear the phrase, "just done at the right moment—but, then, they were lucky"?

One common fault in reorganizing is the rushing in with new systems and methods without thought of the opportune moment. Instances of this kind are many. Typical of these were the experiences of a medium-sized general-engineering plant whose new manager caused endless labour trouble and complete disorganization by introducing piece-work methods before first creating the necessary order and system for this to operate successfully.

In similar vein is the too hasty introduction of paper-work systems, only to find that one or more peculiarities forbid the systems' functioning as planned, or alternatively that the forms designed do not cater for certain essential advice. This is a most common failing, and one very easily fallen into. Industrial organizers are well aware of this and take steps to provide against it. Usually this takes the form of not proceeding with the actual introduction of any system, such as, for instance, a works order system, until it has been submitted for discussion to a round-table conference of the heads of all departments concerned in its future operation. By this means a given scheme is completely ventilated, and an opportunity is created to iron out any snags which may exist before the scheme is put into operation. This is the more necessary as it is seldom that a system, however successful in one business, can be used in its entirety elsewhere.

A large foundry, probably the most efficient of its kind in the world, clearly demonstrated the need to move at the right time by utilizing slack periods to put its house really in order. That it suddenly burst forth as a most efficient concern after years of very mediocre existence, and captured market after market in rapid succession, was entirely due to the fact that it had used a period of depression to overhaul its methods completely, and to introduce first-class mechanization. The foundry concerned was by no means in a privileged position to be able to do this, on the contrary, many others at the time were in every way more fitted to take this action but failed to grasp the proffered opportunity.

It is often a tale of missed opportunity. War-time produced many such examples. There were, for instance, many of the type, like the small firm engaged in peace-time on the manufacture of small artistic products, who entered an entirely new field and undertook, and prospered in, the manufacture of leather-goods for the services, while many firms already in some very similar branch of the leather trade were forced to disband and accept agencies and the like.

Of the hundreds of companies which at this time went over to the production of entirely new products few, indeed, did so in any mere venturesome spirit. Such a move was the result of a recognition of the needs of the hour, combined with a faith in themselves, which knowledge of the possession of a good organization alone can give. The existence of the latter was indeed the reason why so many newcomers to the general armament field produced results far surpassing anything reached by some companies who had spent their lifetime in the same class of manufacture.

Indeed, an analysis taken of a wide range of war-time enterprises proved beyond

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a shadow of doubt that the attainment of the highest efficiency was controlled not by length of experience, but upon the degree of organization held. It could not have been otherwise. The provisions required for organization of production, although more complex in some classes of manufacture than in others, involve the same principles, and largely the use of the same organizational functions. Where the newcomer often scored was that, despite his lack of knowledge of the product, he was able to apply a far higher standard of buying, planning, manufacturing, and general all-round methods than possessed by the peace-time manufacturer.

If choosing the hour correctly means anything it is that not only is the right time to organize thus determined, but also that possible dangers are thus anticipated and consequently circumvented in time.

A very practical illustration of this was found in a Continental cabinet-making factory employing some 300 workers. This was a business which had risen rapidly and acquired an outstanding reputation for always being able to deliver the goods. In trade circles this reputation was largely one of envy, because, whatever adverse conditions were prevalent at any one time, and no matter how badly the rest of the trade was affected, the company never appeared to falter, but was always on the job with prompt service of good quality products at a cheap price. So marked did this superiority over competitors become that it was obvious that the company operated by far better methods than its competitors.

When in due course an opportunity arose for these to be studied it was found that the main difference between the company and its competitors was the operation of this policy of choosing the right time to introduce improvements and take precautionary steps. This policy, indeed, permeated the entire business, being applied in some form or other to practically every activity. That it was applied to buying, for instance, was the reason why frequent temporary hold-ups which the trade experienced in imports of certain classes of timber, or fluctuating rises and falls in prices, left the company completely unaffected for long periods.

It was, however, in its application to work in the factory that this policy was most pronounced. One instance of this was very prominent in the policy of maintaining a tool-grinding section, where spare sets of cutters not in service were ground ready to be quickly substituted for worn and broken cutters withdrawn from production from time to time. The advantage of this repair and regrinding service was of a two-fold character. It ensured not only continuity of production by obviating hold-ups to machines awaiting reground or replacement tools, but it also guaranteed quality of production, in that all tools were thus ground to correct form by specialists.

It was explained by the management that conditions had not been always thus. Before the introduction of this method it had been a most common occurrence for first one machine and then another to be held up while waiting for the resetting of tools. This had been bad enough, but worse still was the fact that more often than not the work, when eventually completed, was found to have been incorrectly carried

out—a fault which was often only discovered after considerable work had been machined. In the words of the management, “If we left the grinding and resetting of tools to the average man in the factory, especially the skilled man, discretion would be used, and we find that we cannot build cabinets on discretion.”

Probably, however, the best example of stitch-in-time policy in the factory, and the one most applicable to almost any factory, was the organization and practices of the maintenance staff. Indeed, the methods of this section were so good that they have since been copied by numerous other factories.

Under the direction of a very able chief maintenance engineer the work of this department functioned entirely on the basis of “prevention is better than cure.” Realizing the inability of a very small staff to cope with a number of serious breakdowns at any one moment, and the serious production loss which would necessarily follow any prolonged delay during repair of production machines, the activities of the department were designed to prevent, if possible, any such happening occurring. To do this all classes of repair had been allocated into one of two definite groups. The first of these comprised those repairs which could be forecast and therefore could be undertaken at certain predetermined intervals. The second group covered repairs which could not be forecast, as they were unexpected and consequently had no reliable fixed basis of wear and tear on which a time element could be fixed.

The work of the department was so arranged that the carrying out of repairs in group one at certain prescribed intervals did not interfere with production, as the chosen times were at week-ends or at night, when the plant was idle. It was, however, in the handling of the second category of repairs that the company's methods were so unusual, so outstanding, and showed such a profitable return. Here the existence of innumerable latent sources of possible hold-ups was freely recognized, and formed an ever-present consideration of the department. The line of attack was one of prevention, an aim of never allowing weaknesses to mature into major causes of hold-up.

To carry out this policy in practice the maintenance staff worked different hours than the rest of the factory. Arranged on a shift-rotas system, it meant that one-half of the staff always commenced work one hour before the rest of the factory and the other half finished one hour later, at closing-time. Hours were so arranged that the entire maintenance staff were at work during the factory lunch-time period. It was at these three periods before commencing-time in the morning, after closing-time at night, and especially during the factory's lunch-hour break that extra-special steps were taken. At these times every day the maintenance staff set out on a mission of fault-finding. This was most intense during the lunch hour, when the whole staff carried out a thorough inspection of the plant, with a view to finding any worn or damaged parts likely to prove a source of breakdown in the very immediate future. To do this systematically, thoroughly, and to time each section of the staff had its own clearly defined duties. Some were concerned purely and simply with the state

of all leather belts in the factory, others with chain-drives, while others inspected electric motors, cam and rocker mechanisms, etc. Nothing was left to chance. The inspection of leather belts, for instance, was a most drastic affair. Any belt, although not actually damaged, but which appeared worn and in any way likely to snap through sudden tension, was either reinforced, relaced, or replaced. Nothing was given the benefit of doubt. Mechanisms showing signs of wear or excessive heating were immediately attended to, which, more often than not, involved being replaced on the spot by a new part withdrawn from the stock of spares which the department always carried.

As can be appreciated, the operation of this system for a time made the maintenance staff so proficient in diagnosing impending faults that even minor hold-ups to production through breakdowns became an extreme rarity. Most satisfactory also from the management's viewpoint was the fact that the achievement of such excellent conditions did not involve high maintenance charges. This, indeed, was the case. Even if we disregard the manifold savings which such a system brought, actual maintenance charges were less than those of competitors. This was largely accounted for by the fact that the latter were for ever faced with high overtime costs, incurred as a result of their maintenance staff's being forced to work long hours in order to cope with one major breakdown after another.

The 'time' element is indeed one of the most important factors in present-day production. Where many go astray is in considering it in relation to manufacturing operations only, and not in its widest and best sense of involving the need to make a plan for each and every activity, and a programme for the development of certain activities and the business as a whole.

CHAPTER IV

ORGANIZATION AND BUSINESS GROWTH

THAT so many British companies have need to undergo a series of reorganizations during their lifetime is the result of failure to provide successfully for development and growth by the introduction of organization in easy stages and in advance of actual requirements. Where this applies expansion comes not as the result of normal progression, which can be readily absorbed from time to time, but in the nature of spasmodic bursts, which have the effect of stampeding all concerned, and generally throwing the entire machine completely out of gear. The underlying cause of such conditions is not only an all-round hesitant policy, but also a fairly widespread and, in some quarters, firmly held, belief that organization in its truest sense becomes necessary, and, indeed, serves its best purpose, only when applied to a business of size.

Never, of course, was there a greater fallacy. Organization is just as important in the small concern as in the very large one. It is indeed indispensable to all. Without it no one concern can possibly prosper to any appreciable extent, or develop and expand in true and sound measure. This is an undisputable fact, which every small or medium-sized business should take soundly to heart. It has its origin in the fact that the principles of organization are constant and equally applicable to each and every type and size of concern. Where the main difference lies between its application in the large and small concern is the extent to which each business function is undertaken. Thus, in a rough sense, is a question purely and simply of the numbers of staff which the two types of concern have need to allot to each activity. Where, for instance, a large company may employ large numbers of staff to control various activities, the numbers would be correspondingly reduced in lesser-sized companies, until in the case of the very small concern the representation of the very same activities may be vested in a single individual. Conversely the growth of a small business creates an expansion of organizational activities and the need for increased numbers of people to run them. Under good organization, however, there arrives the stage, usually one of the employment of several thousand work-people, when the size of the staff does not increase in ratio to the total pay-roll, but remains constant even with considerable variation in the total number of employees. It is from this point onward that overheads can be made to take a steady downward climb. Here, indeed, is a truth which more than one large industrial combine has yet to master. Amalgamation in their case is only too often the figurative grouping of a number of companies within a company, for, lacking any appreciable attempt at centralizing the

activities of each unit into a workable whole, the average combine stands as a perfect example of gross duplication of activity

Being saddled with excessive overheads is not, of course, a failing peculiar to the large combine. This state of affairs is, indeed, common to many large and medium-sized concerns in all manner of manufacturing pursuits. In the majority of cases it exists primarily as the result of faulty reasoning as to the extent of overheads which companies can and should reasonably bear. In many branches of industry, for instance, the mistaken belief is held that low overheads are only possible in firms employing less than 2000 people, and that thereafter overheads must necessarily rise in proportion to the size of the pay-roll. Nothing, of course, is farther from the truth. Not only can overheads be made to take a downward trend coincident with an expanding labour force—as the result mainly of an increase of productive labour as opposed to indirect—but it has been proved over and over again that efficient organization in the large concern can produce overheads comparable in every way with those of firms of much smaller size. Naturally factors such as design and research, etc., have an important bearing on overheads, but where these and similar expenses are not all heavily weighted on the side of the larger company it is able to compete comfortably with its much smaller competitor on this question of overheads. Numerous indeed are the cases of medium-sized companies who, despite having a goodly proportion of intricate machine work in their type of manufacture, manage to operate successfully with an overall overhead which many smaller concerns have cause to envy.

Faced as industry is with a huge rehabilitation programme from war-time to peace-time activities, embodying the conversion and utilization of buildings and plant on an unprecedented scale, and the use of men and materials in ways far different from those to which industry has grown accustomed, it presents problems of a magnitude and variety which call for every atom of clear thinking which business-men can possibly apply, together with the application of the finest possible form of organization. Indeed, whether the project on hand be the conversion to peace-time use of a large shadow factory, or the building up of a production which has been kept going on a reduced scale throughout the war, the solution is the same—namely, adequate organization.

Failure to obtain the best kind of growth and development is, however, by no means entirely due to the holding of any fixed ideas as to the size of plant in which organization should or should not function. More often than not it occurs in businesses where its principles are welcomed but completely misunderstood. In other instances it is the small and completely overlooked point which is the source of the trouble. In all these cases, however, hold-ups to normal development can usually be traced to either the wrongful use of staff, or a far too rigid sense of economy, or alternatively failure to take action at the appropriate time. Instances of shortcomings in each of these are, of course, many and varied, but even so, in view of the very dam-

aging effects that each can have on the progress of a company, it is proposed to deal with a few of the types most commonly encountered in actual practice

Effects on Business Growth

The effects on business growth of failure to apply a stitch in time are not always obvious but can remain hidden for considerable periods, if not indefinitely. In some cases this neglect can be the cause of drastic repercussions obvious to all. In others, although hiding beneath the surface, it constitutes the reason why that little extra efficiency is never forthcoming, and consequently a company never seems able to get out of a groove. In no cases, however, can this failure be disregarded as unimportant without serious consequences.

That many do view it in this way is one reason why so many companies constantly advertise for factory managers and the like in the hope that a superhuman man will be forthcoming to quickly right the wrongs which have been committed over a number of years.

The experiences of a certain individual in this direction are both highly enlightening and amusing. This man, a student of organization, blessed with a most inquisitive mind, made a practice of answering this type of advertisement. He was actuated not by any intention of accepting, even if successful, but in order firstly to test his ability to compete still in the open market, secondly to study the interviews as carried through, and lastly in order to gain all possible information on the various types of organization each one used. In so doing he had many strange experiences. First and foremost there was the only too frequent type of company which, despite colourful trimmings, required almost immediate results if it was to continue to operate. Then there was also the not uncommon type which begrudged even a reasonable salary for the exacting duties it demanded. Foremost among these was a particular case where a company advertised the position of works manager over several hundred employees. At the second interview, however, it was made perfectly plain that the chosen candidate would be required also to carry out personally, without assistance, the specific jobs of estimator and planning engineer. The reason given for this was that it would curtail unnecessary expense. Of another type was the medium-sized factory which expected the first step of its new works manager to be the settling of a strike, which it was known had occurred as the result of the shockingly bad wages paid to its workers. For this and normal works manager's duties the company offered a salary of a few pounds per week. By no means uncommon among these advertised posts was the type of concern which, although of a much better standing than the cases referred to, erred in an even more serious way. This type, although offering a decided measure of stability and satisfactory remuneration, did in effect intend to saddle its works manager with full responsibility for all faults, but deny him the power to put things right.

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These actual experiences, although not a 'case' in themselves, serve as a means of still further illustrating the poor policy which does exist, as business investigation on a wide scale has already proved, in fairly widespread form throughout British industry

Often a company's failure to make the requisite grade can be attributed entirely to the incorrect delegation of authority, or the inadequate remuneration of staff. Both are equal evils, and where either is rife a good man seldom stays long.

More often than not, however, these faults are allowed to exist through a non-appreciation of their importance rather than through deliberate action. This is certainly the case in those many instances where a company's prospects are seriously impeded by incorrect assignment of duties and authority. This unhappy state of affairs, which brings in its train a series of rank inefficiencies, causing on the one hand serious overlapping, and on the other gross neglect, is often due entirely to a management's complete inability to decide just which job belongs to whom.

The general rule is simple. Duties for individuals, to be correct, should be determined around a number of set functions, which are, indeed, true for any business and increase or decrease in magnitude only according to its size and the intensity of any specific activity, or both. A given function, for instance, which in the large factory may be represented by a departmental head, with several assistants and a large staff, will on the other hand often be carried out in the small organization by one person. In still smaller firms more than one function may of necessity have to be invested in one individual. It is most important, however, if progress be desired, that the performance of any function should on no account be ignored in even the most humble concern.

These functions are in reality the break-down into various activities of the three main divisions of any manufacturing business—namely, finance, production, and distribution.

In total these are as follows

<i>Divisions</i>	<i>Functions</i>
Finance	{ Accounts Costs Purchasing
Production	{ Manufacturing Methods Equipment Labour
Distribution	{ Design Advertising Selling Transport

In large concerns many, if not all, of these functions are subdivided into a number of departments, each with its own departmental or section head. The average small

and medium concern, however, will not go far wrong if it considers each function as one person, to be given assistance should the size of the activity demand it

It is, however, in the production division that so many companies experience difficulty in correctly allocating duties. This largely comes about because activities are more correlated in this division than in either finance or distribution. They are also not so self-evident. Probably, however, the chief reason for the confusion lies in the fact that it is the production division which involves so many activities, such as production control, planning, time study, progressing, etc. It is known that many companies experience difficulty in assigning these duties, especially with regard to their relationship to the works manager and supervisory staff.

The position can best be dealt with by a consideration of the activities of the production division in an engineering concern. Manufacture is self-explanatory, standing for all matters connected with direct and indirect labour required for achieving, supervising, and maintaining actual making of goods. The function of labour is equally self-contained, being concerned with the engagement and enrolment of personnel, together with necessary welfare activities. Equipment stands for the choice, erection, and maintenance of all factory plant other than machine-tools. The head of this function would be the equivalent of a works or plant engineer.

The most involved function is that of methods. The activities involved are planning, time study and rate-fixing, jig and tool design, production control, and inspection. Who takes charge is a matter which varies according to the size of a factory and the relative importance of the activities in any particular business. In the medium-sized concern, for instance, it is usual for these activities to be controlled by five separate individuals, who are responsible to a production engineer or manager, who in turn is responsible to the works manager. From medium to large concerns onward, the importance and magnitude of inspection makes it desirable for the chief inspector to be directly responsible to a higher authority, such as the general manager, or manager, as the case may be.

The same applies to the post of production manager. Although in the smaller companies this official is responsible to the works manager, in large companies he is often of equal standing. At a higher level, as in the case of a combine with a number of factories, he is superior in rank to the works manager of any one of them.

Technical research, a very important activity in any large company, is catered for under the function of design, in the distribution division. This activity is also often the subject of direct responsibility to the head of the company.

Any company, therefore, faced with difficulty of determining duties can best settle the matter by viewing it as one of activities rather than so many individuals. Responsibility for progressing of orders, for instance, leaves no qualms as to the person actually concerned if it is viewed as a branch of production control, which comes under the function of methods and is the direct responsibility of the production manager, or his equivalent.

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Indeed, the main purpose of organization is to provide for this correct assignment of duties so that all activities of a company shall be handled simultaneously by a team, and not be dependent in turn upon the spasmodic treatment of an individual. Failure to allow for correct representation of these functions results in a company's being either sadly under-organized or, at the other extreme, excessively overstaffed.

The Overall Result

Basically it is indeed due to the existence of one or other of these evils that a company's growth and attainment of efficiency is seriously impaired. No company can function as it should, and move with the times, if its organization be unbalanced. The symptoms of such conditions manifest themselves in innumerable ways. Often these at first sight appear relatively unimportant. There is, for instance, the general feeling of a company's being at cross purposes and unable to work smoothly as a whole. Most marked, too, in such conditions is the apparent inability to tie down responsibility for neglect or customers' complaints. High costs or heavy expense are other factors which a company with unbalanced organization never really succeeds in substantiating, let alone curing. Not least of all these symptoms is the difficulty of securing a staff's adherence for any length of time to definite instructions laid down by the management.

The state of the under-organized concern is akin to that of the type of person who never really makes the grade in high positions owing to his disinclination to delegate a given volume of work or activities. Just as sooner or later the inefficiency which must of a necessity accrue from such a practice reacts to his ever-growing disadvantage, and starts him on the downward path, so it is with a company. In some cases the downward course is short and drastic. In others it may be prolonged in the perpetuation of a series of inefficiencies, which make all the difference between a good and a bad balance-sheet. This naturally precludes not only reasonable development, but also a just and proper return.

That a small company often continues to exist despite a very under-organized state is more often than not due to the extreme versatility of one individual. With the loss of this person, however, matters usually speed to a climax. There are many known instances of this. One very marked case existed in a one-time, small glass-works, employing some 250 workers. That this company existed at all was due to the versatility of the factory manager. This individual was, indeed, king of all he surveyed. He made his own estimates, undertook all buying, planned each job for the factory, fixed his own piece-work prices, was responsible for quality, produced his own costs, and, in short, personally undertook every major issue connected with the place.

Business grew, and under the strain he became seriously ill, from which he never recovered. In his place numerous other managers were tried in rapid succession.

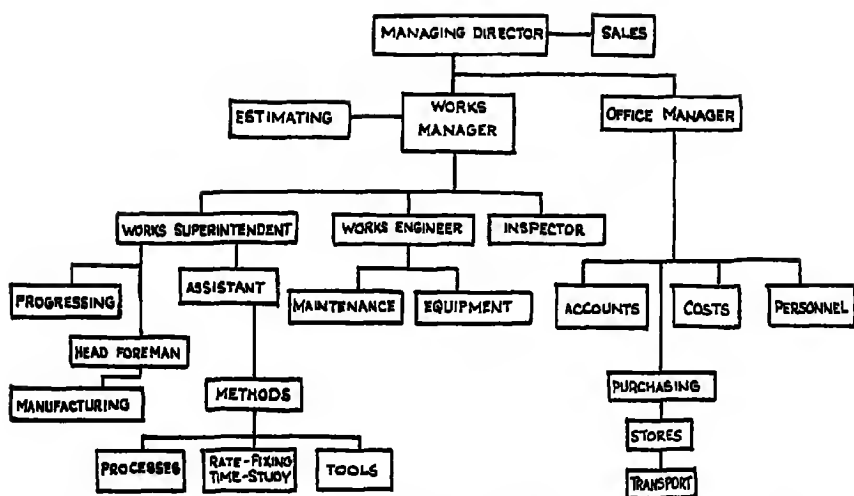


FIG 6 ORGANIZATION CHART OF A LARGE COMPANY AT THE FIRST STAGE OF ITS GROWTH

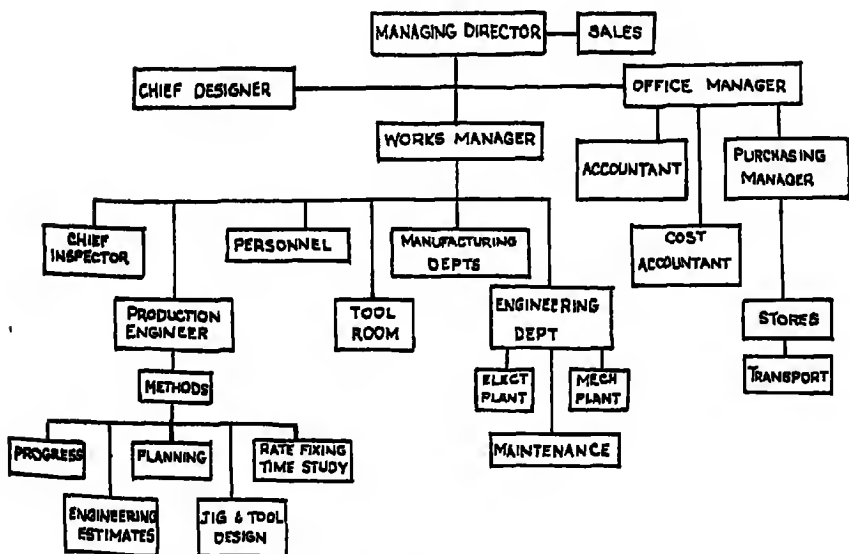


FIG 7 ORGANIZATION CHART OF A LARGE COMPANY AT THE SECOND STAGE OF ITS GROWTH

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Many of these were good men, but as none were in any way as versatile as their predecessor they followed one another in endless procession. Yet the directors did not learn from this experience, and just before the final closing of the factory doors they were still searching high and low for a replica of their previous works manager.

Cases of under-organization do not, of course, always terminate so drastically. In some nothing ever happens except that a company goes on year after year marking time and losing much money and advancement in the process. In other cases, however, the effects become so serious that sooner or later drastic reorganization becomes imperative. The extent of the latter is clearly evidenced by the large number of reorganizations which are carried out from time to time in so many branches of industry.

An example taken from the woodworking trade is especially chosen because it will illustrate the pitfalls which confront a growing business. Of a type doubtless familiar to many is this case of a furniture-making business which began with a practical cabinet-maker starting in business for himself in an attic of a large dwelling-house. As time went on, and the quality of his craftsmanship became appreciated, orders grew to an extent beyond his capacity to execute, and he was forced to employ help in the form of another cabinet-maker and a youth. Still further business came in, and premises, in the form of a loft over a stable, were duly acquired in order to accommodate the cabinet-maker and his employees, which by now totalled ten. With orders still increasing month by month, the business in some two years had a pay-roll of fifty people, and was established in an old school, possessing for the first time in its history an entirely separate little office manned by a small staff. The owner, still doing practical work at the bench, was, however, by this time forced to give part of his time to supervising office-work and the other workers, and to the creation of new designs, for which he had an undeniable gift. Despite such divisions of interests, however, the business, due largely to the excellence of these designs, continued to expand. So much so that in about five years the cabinet-maker found himself the employer of some 250 workers, and in the fairly substantial premises of a one-time engineering works.

From this date onward, however, matters did not proceed too well. The owner, having the firm conviction that no craftsman in his employ was capable of producing certain work as good as himself, continued to potter about in the works as well as trying to run the business. As the size of the business at this time, however, made designing, purchasing, production control, and many other factors almost full-time jobs needing expert control, each activity suffered in proportion to the degree of inattention given to it. This was by no means constant, for as the owner concentrated almost in desperation on the most pressing evil of the moment, equally serious evils arose in other sections of the business. Under such circumstances it was not surprising that the business for the first time in its existence began to falter and lose the reputation it had built up for quick delivery of excellent designs produced in first-class quality at reasonable prices. This led to orders falling away, at first little by little, and then

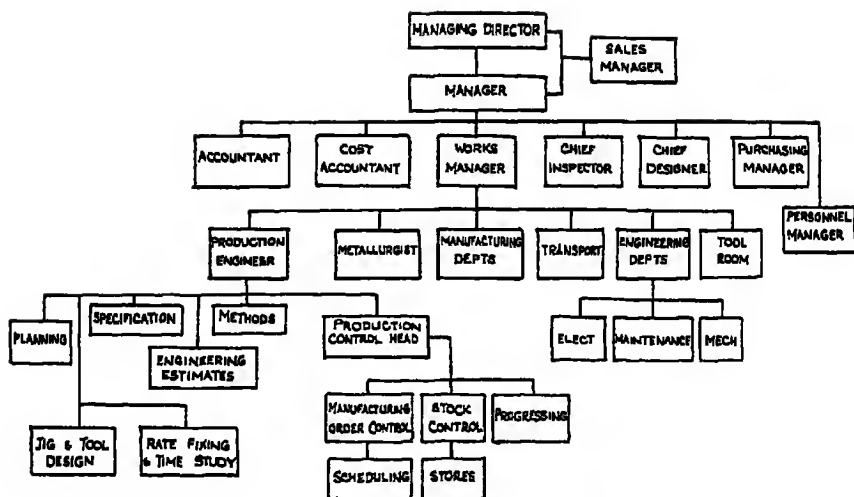


FIG 8 ORGANIZATION CHART OF A LARGE COMPANY AT THE THIRD STAGE OF ITS GROWTH

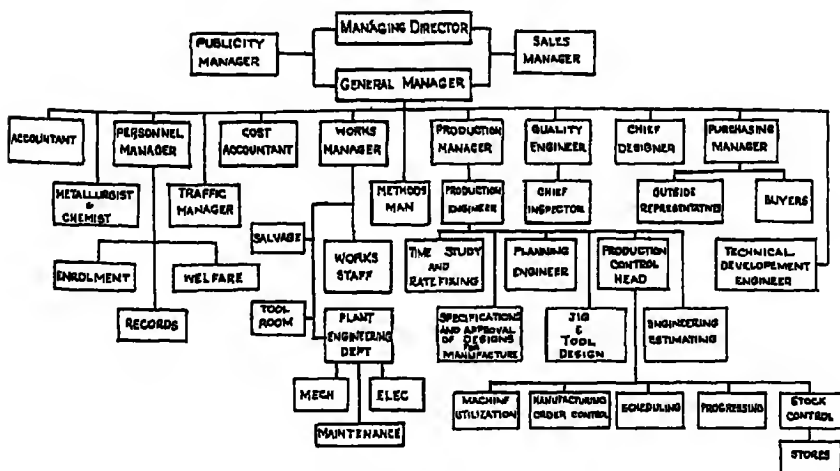


FIG 9 ORGANIZATION CHART OF A LARGE COMPANY AT THE FOURTH STAGE OF ITS GROWTH

in increasing volume as customers began to complain of either inferior designs, faulty workmanship, poor material, or non-delivery to time. Finally the position became so acute that it was evident even to the owner that it was physically impossible for one man to combine so many diverse activities, and attempt to run a business single-handed.

Fairly widespread reorganization, therefore, became the order of the day. The effects of this were minimized by its introduction in two stages. The first step was the introduction of an office manager and a production manager to take charge respectively of all office and works functions, leaving the owner, with the aid of an augmented designing staff, to concentrate on design.

The value of the results which were quickly forthcoming from such an intermediate move made possible a further and final readjustment of duties some twelve months later. This set the basis of the organization which eventually led the company through continued progress and expansion to become one of the largest of its type in the world, and the proud possessor of a thoroughly justified international reputation.

Over-organized concerns usually evolve as the result of interpreting faults as meaning the need for still further assistance. A second cause is the direct result of the application of too many systems. Usually one follows the other. Systems bring in their wake the need for people to run them, and conversely an increase in people operating in special roles brings a corresponding increase in the number of systems.

Although over-organization is not so common as its other extreme, many examples of it can be found in various classes of manufacture. Fortunately, however, the type of business is fairly rare which over-organizes deliberately, with the mistaken impression that in so doing it is wisely providing against some future requirements. A case of this type was encountered in a small engineering works engaged on sub-contract work of small machined parts. Here, despite the fact that only 50 people were engaged on actual production, overheads were in the region of 350 per cent. This was incurred by the existence of a staff out of all proportion to the volume of work handled. When analysed it was found that by far the greater proportion of this excessive cost was involved in the employment of four highly salaried production officials. The use of the latter especially puzzled the investigators. It was obvious, for instance, that the extent of the company's activities in no way justified their inclusion. Equally apparent was the fact that they did little work, as each one appeared to hesitate for fear of treading on the corns of the others. It was to find the reason for such flagrant waste that the owner was finally queried. The reply was quite firm and definite. It was most carefully explained that it was fully appreciated that the staff were not being used to advantage. It was not expected that they would be at such a stage. They had most decidedly not been engaged for present utilization but with an eye to the future. The express purpose of their engagement was, indeed, a move to be in readiness to handle greatly increased volume of work and consequent expansion as and when this came along.

In applying this very unsound reasoning the owner had forgotten two very important facts. First was the fact that he was a small man with very limited capital available, second, that while in the past there have been known instances of companies in very specialized types of trade winning through by such methods, those days have gone for good, as production nowadays is more than ever a question of sound economies. Forgotten too was the fact, as was eventually borne out in practice, that men used to large-scale production are usually out of their element in such conditions, and seldom stay long. Further—and this is important to those who are for ever begrudging the large companies the use of such men—it is rare, indeed, that large-scale production executives serve any real purpose where limited quantities are concerned. Indeed, the success of the large mass-production concerns does not come about by the employment of super-men or magicians. Far from it. They are specialists, it is true, but nevertheless, as they would readily admit, they are in no sense the miracle workers as some onlookers deem them. Their success, and the success of the companies they serve, arises not from the outstanding ability of the individual, but from good organization, which clearly defines correct delegation of duties and co-ordinates these into the workings of a united team.

Although every company must naturally guard against over- or under-organization, the matter is of special importance to new or growing businesses. Companies in these categories, when worrying how to build for the future, should remember that it is essential first to manufacture correctly, and then organize in stages as growth develops.

CHAPTER V

WHAT TO LOOK FOR

THIS can probably best be accomplished by pursuing the matter in the same way that many industrial consultants after years of experience have thought fit to adopt. Briefly this involves a preliminary survey of a given business as a whole, followed by detailed investigation of the work of each department or activity. While the latter makes possible an assessment of the efficiency in each department, and affords an indication of the nature and degree of improvement possible in each, it is by means of the general survey that a wider and more useful picture is formed. This not only serves to show the relation of the office to the shops, for instance, but enables a picture to be obtained of the general standing and all-round efficiency of a business.

A survey of this type would normally take the lines of following the course which an actual order would take, from the date of its receipt to ultimate dispatch. By so doing it is possible to assess not only the merits of the treatment given to an order at succeeding stages in its journey, but, more important still, to decide the relative value of each and every activity to the main issue of any manufacturing business—namely, correct and proper production. This would include consideration of the extent to which such factors as planning, production control, costing, etc., were undertaken. It would also involve consideration of the efficiency of actual manufacture itself. Not least of the attention paid to this latter category would be that given to matters of lay-out and the general state of order and cleanliness existing in the factory.

While as a rule lay-out is not given the degree of attention it deserves, it is yet in the total disregard of normal order and cleanliness that so many companies gravely err. The result is positively to preclude the achievement of maximum efficiency from any given set of manufacturing processes.

It is, indeed, hard to connect efficiency in any way with those many works, where movement of people through the shops is only possible by repeated clambering over piles of material, or where the negotiating of a truck through any given department becomes a major issue, calling for no mean skill and resource on the part of the wheeler. Conditions such as these are by no means exceptional, but are to be found in fairly widespread form throughout many industrial areas in Great Britain. Whether as the result of a lack of appreciation of the seriousness of such conditions, or of some ill-conceived conception of the economic use of space, their very being constitutes a perpetual drag on the profitability of other activities and the general standing of any company.

Apart from this question of the effects of limitation of movement on men and materials, lack of reasonable cleanliness is in itself a grave fault, in that it has a very definite adverse psychological effect on workers in the factory. This usually finds expression in the quality of the goods produced. It has, for instance, been proved over and over again that untidy working-conditions results in untidy and shoddy work being produced.

It is, indeed, to provide against both these evils that the efficient company takes very definite steps. This takes the form of controlling the state of the shop floor by regulating material-issue from the stores, and by the creation of regular passage-routes for goods and persons. These routes, marked by white lines on the floor of a factory, are regarded by some companies as so essential to good order that their maintenance is a matter of high importance to factory service departments. In this the latter are supported by a policy which entirely forbids the encroachment on gangway-space of goods in temporary or permanent storage, and makes offences in this direction subject to severe penalties.

Although this practice of establishing routes has grown to the extent of being a fairly common procedure in many branches of industry, there is still a good number of concerns which have yet to profit by its adoption. The objections of many, as, for instance, certain sections of the sheet-metal industry, that the nature of the work carried out precludes any arrangement on these lines is ill-founded and, moreover, completely disproved by the many excellent examples already existing in these trades.

The correct state of the factory floor, however, is dependent not only on the removal of congestion by the provisioning of recognized transport-routes and passage-ways, but also by the way in which machines and processes are arranged in any given department. This involves consideration of the primary basic need of any manufacturing plant—namely, good lay-out.

Lay-out

In arranging lay-outs it is often forgotten that the point at issue involves not merely the best arrangement of machines and processes in a given department, but, more important still, embraces the positioning of departments in correct relationship one to another. It is, indeed, in this latter connexion more than in the case of single department grouping that so many companies go astray. This is most noticeable in premises which are multi-storey or of the old-fashioned single-storey, rambling type.

In many such premises, especially where old-established businesses are concerned, one often finds lay-outs which have operated entirely unchanged since the days of the original founding of the business. This failure to move with the times—often the outcome of an exaggerated sense of conservatism, and based largely on the theme of "what was good enough for my father"—proves a definite bar to progress, and succeeds only in perpetuating obsolete methods and the features of early building.

mistakes. Whatever the cause, however, with a little ingenuity and a good measure of sound common sense, there is no reason why the limitations of old-fashioned buildings should prove any serious obstacle to the promotion of reasonably efficient lay-outs.

An example of what can be done in this direction is contained in the following experiences of a company in a branch of the fancy-goods trade. This company operated in a very old-fashioned, four-storey building, which it had occupied right from the days of its formation. Despite the fact, however, that the manufacture of several of the company's products had been discontinued during the course of the years, and that the business had largely developed into one of a specialized nature, concerned almost entirely with one product, the factory still operated under its original lay-out, wherein work on a departmental basis was carried out on each floor. This involved a considerable amount of handling and movement of goods, as parts in course of manufacture were taken from one floor to another for different operations and processes to be carried out. This was no mean proposition. Indeed, seeing that a goodly number of operations and processes were involved on practically every part in the product and the equipment necessary to carry these out was liberally scattered throughout the various floors, the factory's outstanding activity became one of incessant movement of goods from floor to floor. That this was costly in time and money was evident by the small army of workers who were ever to be found struggling in dimly lit passage-ways and on awkward winding staircases with heavily laden boxes of parts which were destined for one or other of the floors.

This state of affairs would, however, have probably continued indefinitely had not keen competition arisen in the trade by the arrival of newcomers. The outcome of this was to create a need for both appreciable reduction in selling prices and considerable improvement in delivery. As a last resort the company was forced to seek advice. Thus they did, strangely enough, not out of any belated recognition of the outstanding evil of their lay-out, but as a specific request for help in choosing a suitable progressing or material-control system. The result of investigation, however, clearly defined the need as being one for a thoroughly reorganized lay-out, which, after solving the immediate difficulties, would then lay a solid foundation on which the company could build for future success.

The type of lay-out eventually decided upon was chosen with one object in view—namely, to utilize every possible advantage of the building to gain the maximum amount of forward flow of production. It was realized that, given this 'forward flow,' not only would a considerable amount of the handling involved in carrying to and fro be consequently immediately eliminated, but that still further reduction would then be possible by achieving actual movement by simple mechanical means.

The final, completed lay-out did in fact give these advantages. Introduced in stages in order to avoid serious dislocation to production at any one moment, the governing principle was one of progression of work from the top floor downward.

To accomplish this operations and processes were arranged in sequence, floor by floor, with operation number one on the top floor, and the last and final operation on the ground floor adjacent to the dispatch department. Incoming material, which was light and compact in nature, was delivered by a hoist to the top floor of the building, where at one end of the department operation number one was undertaken. Work was then progressed operation by operation across the department by means of roller-gravity conveyors until, having had its last operation or process on that floor completed, it was dropped by gravity chute to the next floor. This procedure was carried out in turn on each floor until the completed product finally arrived by gravity chute on the loading platform of the dispatch department.

It is not suggested that an arrangement of this type, to give 100-per-cent continuity of flow, can be applied to every multi-storey building. Obviously the ease with which a product lends itself to this treatment is the deciding factor. Limitations, for instance, would be experienced where a wide variety of products was concerned, or where the manufacture of products or parts calls for the same type of process to be repeated at various stages of production. What is stressed, however, is that the principle stands good, and should be applied to the maximum possible extent in every building of this type.

The chief faults of many lay-outs in the old-fashioned, single-storey, rambling type of building is also one of unnecessary movement, both of people and of goods, when in transit from department to department. Although this takes place on a different plane than in the case of the multi-storey building, the effect is often even more serious. Indeed, cases have been known where movement of goods in this type of building has far surpassed anything encountered in a similar type of manufacture undertaken in the multi-storey type. The effects are particularly severe in those cases where the type of manufacture necessitates dealing with bulk or heavy articles. Old-fashioned engineering companies engaged in medium-heavy branches of the trade are particular offenders in this direction. That these conditions exist so freely, when the remedy in each case is often comparatively simple, is undoubtedly due to complete lack of any application of the principles of time and motion study. For some peculiar reason there appears to be a distinct tendency among companies manufacturing large or heavy equipment to regard time and motion study as more or less really only applicable to the fast and continuous production of small and light articles. In reality this is very wide of the mark. Time and motion study, far from being by nature restricted to any one sphere of production, is, indeed, very necessary of application to each and every single aspect of any company's activities from which improvement can be derived.

That unsatisfactory lay-out conditions in these old-fashioned works can often be overcome by very simple means has been more than freely demonstrated on many occasions in the past. The type of action taken is more or less summarized by the experiences in this direction of a large, old-established engineering company. The

company concerned occupied a very old building, in which it produced long-established products of a size which classified the company as a medium-heavy engineering concern. Like so many of its type, it had established different works activities in different departments without any apparent thought of their correlation. Consequently the departments adjacent to each other were often those which had very little connexion, while those farthest removed in distance had need for almost continual contact. As a case in point, the pattern shop and the foundry were two departments which were, in fact, positioned the farthest possible distance away from each other, in the two extreme ends of the building. The position was aggravated still further by the existence of a great number of completely unnecessary internal walls. These bounded each department, producing an atmosphere of self-containment where this was most undesirable, and greatly adding to the already tremendous amount of unnecessary movement which existed in the plant. Indeed, with few doorways existing in the walls movement across the plant became not only tedious and circuitous, but one that brought a great measure of congestion at many points. So bad was the latter that at practically any part of the day workers could be found hanging about in groups at some doorway, while trucks from opposite directions attempted to squeeze through confined spaces at the same time.

Even so it proved difficult to convince the management that improvement was essential. Although readily acknowledging the correctness of the picture depicting the evils of the lay-out, they were far from convinced that the matter was serious, or represented any appreciable loss to the company. As a result, therefore, it was decided to produce the facts in graphic form. To that end, a census was taken of all movement of goods and people over the company's chief internal traffic-routes during the course of one full day. The facts, when obtained, were produced in picture form, showing the total distance covered per person during a full working week, the average time taken per journey, together with details in diagram form, of the most frequently used route. Such a representation produced the desired effect. It was, in fact, impossible for the management to be other than profoundly disturbed at being brought face to face with the fact that several hundred man-hours per week were being wasted on people walking to and fro. Probably the most decisive and conclusive evidence from the management's point of view was that contained in the graphic plan of the most commonly used route. This represented in single-line form, showed that the given route between the two departments was more akin to the outer windings of a maze than a frequently-used passage between two not far distant departments.

It was pointed out to the management that although a few doorways made at various points would considerably improve the position, the correct solution lay in a complete revision of the entire lay-out. Wisely the company decided on the latter course, and the revision was put in hand. To-day the company operates in a plant which, although little changed in appearance from the outside, is far different from within. Here production flowing across one wide open space makes not only for

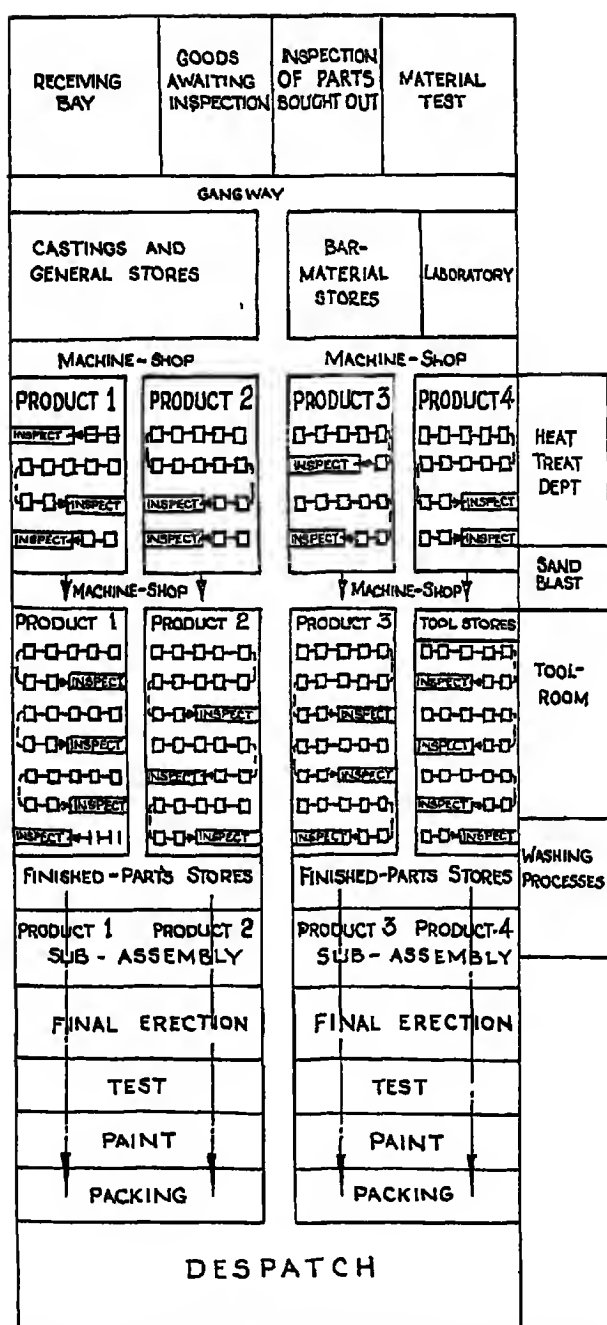


FIG 10 A FIRST-CLASS LAY-OUT OPERATED BY A CONTINENTAL ENGINEERING COMPANY

improvement in itself, but allows that concentration of activities from which all worthwhile benefits are derived

Although faulty lay-out is always considered in relation to its effect on production flow, it can have even more serious consequences. It can be, and only too often is, for instance, the direct cause of the low efficiency obtainable from a given process. That so many different examples of this can be traced to the fault of incorrect lay-out is due entirely to the lack of appreciation of the fact that the efficiency of workers must suffer as a natural consequence of their being wrongly positioned.

Conditions found in a medium- to large-sized clothing factory serve to illustrate just one way in which production can be affected by incorrect lay-out. This factory, despite the existence of seemingly good all-round conditions, could not succeed in achieving anything like a satisfactory total output. It would probably have continued thus had not a visitor one day pointed out that the benches were the wrong way round. These being double-sided benches, with workers stationed on either side, their positioning down the department running parallel with the windows on either side of the room not only obstructed the use of natural light and necessitated the continuous employment of artificial lighting, but produced a general shadow effect, very trying to the eyes of the operatives. A revision took place, and the benches were rearranged across the department at right-angles to the windows. The result was an almost immediate 20-per-cent increase in production from the factory as a whole, but with an increase considerably in excess of this from a large section dealing with mourning orders.

This effect of poor lay-out conditions on the efficiency of workers is not necessarily confined to one of retarding output. It can also be the direct cause of inability to maintain quality standards. Its action in this way is not always apparent. Indeed, in many cases where it operates questions of lay-out appear to be in no way connected with the actual failure to produce quality. It is because of this that so many examples remain undiscovered, and continue to prove a perpetual source of worry to all concerned with production of quality. A typical example was recently encountered in a fair-sized engraving works. In one section of the plant the company carried out a new development in the form of a special machining operation of an uncommonly delicate and intricate nature. Performed on a single machine, it was this process which was at fault. Try as they would, the management could not avoid producing a very high percentage of scrap. As it was essentially a hand-operated process, which could not be jugged or tooled, the company had tried to overcome matters by trying one highly skilled craftsman after another on the job. Despite this and many other efforts, however, no appreciable improvement was forthcoming, and scrap produced by the process remained as high as 50 per cent. Faced with the position, therefore, of having a seemingly non-improvable process, which was nevertheless completely indispensable to the company's plans, the management wisely sought advice. The outcome was the taking of a time and motion study of the particular process. This

brought very illuminating facts to light. It was proved by this means that the large percentage of scrap was entirely the result of the machine's being positioned wrongly. What was happening was that as the machine was situated at the head of a very narrow gangway the operator was subconsciously moving to avoid fancied collision as each passer-by approached, and as this often occurred at crucial moments of a very tricky

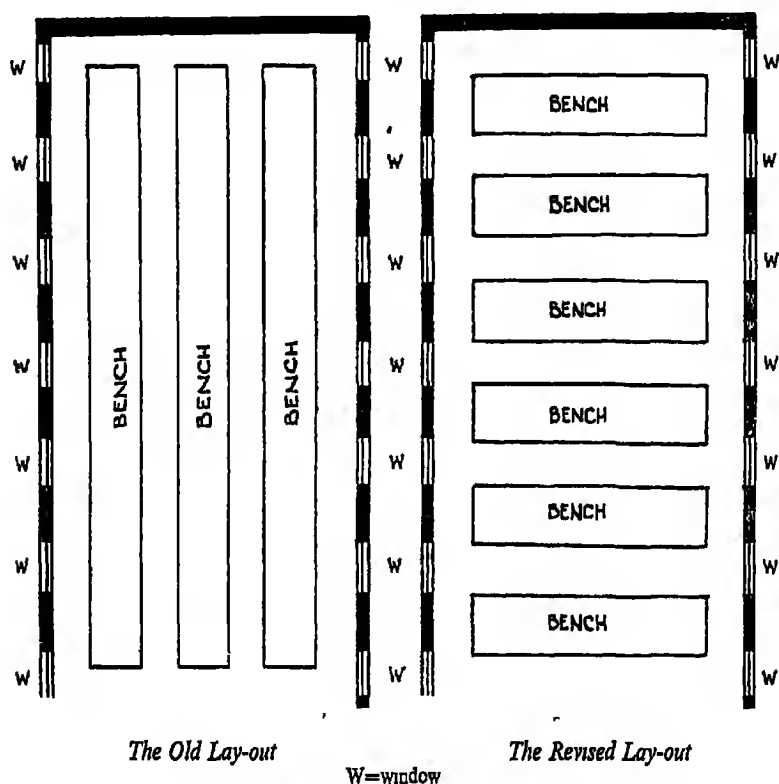


FIG 11 UTILIZING NATURAL LIGHTING IN A SEWING FACTORY

process, the result was a high percentage of scrap. When, as a result of this finding, the machine was moved to a more sheltered spot, and a small area around the machine was fenced off, scrap from the process quickly dropped to well under 5 per cent.

Lack of flow, wrong flow, excessive movement, congestion—all these are factors which can do much to seriously impair the efficiency of any type of manufacture. The efficient and progressive company wisely recognizes this and, therefore, takes all possible precautions to ensure that the manufacturing space at its disposal is used to the best possible advantage. The result is not the attainment of a 'show place' but a workman-like arrangement presenting a foundation on which efficiency from all production activities can be readily built.

Production

That many companies do not manufacture correctly is often due to the fact that the subject is seldom considered by them in its true perspective. Where this applies production, far from being viewed in its rightful sphere as the life-blood of any organization, comes to be looked upon as that necessary routine which must be pursued during the interval of time between the receipt of an order and its ultimate dispatch. Consequently, therefore, it is not surprising that where these conditions exist so too can be found redundant and obsolete methods. The usual sign of the existence of such a state of affairs is the complete absence of any form of planning activities. This in itself is by no means uncommon. There are hosts of factories who even to-day have yet to recognize the value of planning, or conversely to appreciate the manifold dangers of depending for normal progress on the initiative and experience of the often untrained individual. Only too often, for instance, is it left to lowly placed officials, to foremen, charge-hands, and the like, to decide that all-essential matter of just how a company shall manufacture. While many of these are, of course, excellent men in their own way, eager and willing at all times to do their best, they are, nevertheless, in the main ill-fitted by reason of the lack of suitable qualifications and experience to assume responsibility for this all-important task. It often happens that companies which err in this way do so through interpreting experience in this connexion as meaning length of service in a given line of manufacture. In this they are grossly at fault. Length of service in actually producing a given article is no criterion that the holder possesses requisite knowledge to enable him to suggest an alternative way of producing, or to decide just how an article could best be made. More especially is this so in view of the rapid day-to-day developments of modern progress in all spheres of industry. To harness these developments and improvements correctly, and to ensure that a company is at all times manufacturing in line with current practice, calls for the employment of the specialist, a person qualified to assess rightly the relative merits of all modern developments and able to take steps to incorporate these in a company's manufacturing methods as and when the occasion arises.

It is with full recognition of this need to keep up to date in manufacturing methods, and to plan scientifically the best way of doing each job, that the efficient concern concentrates so much on pre-planning. The decision of 'how to make' rests entirely with the specialists in this section, and not with the people responsible for actual production. To follow the reverse course, as so many companies still do, is to put the cart before the horse by leaving decisions of 'how to make' until the moment that the work is due to be actually carried out. Such a practice not only definitely hinders real progress, but does much to promote makeshift methods or the maintenance of obsolete manufacturing processes.

It is by no means an easy task to persuade those who adopt such methods to change their ways. Only quite recently a certain manufacturer in a fair way of business, but whose company it was known was fast heading for trouble, hotly disputed the need for

planning methods His main reason for so doing was bound up in the fact that he considered his head foreman a man who, it was proudly stated, had been fifty years in the trade, knew just as much as, if not more than, any planning specialist about how to make the actual goods His eulogy of the foreman in question reached such a high level that, as a natural course, he was asked why he did not make the man his works manager and let him run the entire plant His reply, although not exactly printable, was based on the theme that the foreman knew nothing about staff management As a matter of fact, it was subsequently proved that this was, indeed, the man's strong point It was in this sphere alone that he achieved any success in the works On ways and means of actual manufacture he was completely lost Being entirely non-technical, and completely unversed in modern manufacturing methods, his attitude in the works was confined to one of playing safe and refusing on principle to make any change to manufacturing methods which had been proved successful in his early days

This placing of a company's very livelihood into the wrong hands brings many evils in its train One particularly pernicious example which usually thrives amid such conditions, and which in itself perpetuates the existence of obsolete methods, is the flagrant practising of victimization Only too often, for instance, is it a case of God help the studious apprentice who, as a result of attending night school, dares to suggest a better way of performing a given operation or process The case for planning and actual manufacture to be separate functions is not, however, simply built up around the non-technical foreman It applies equally to all types of works and factories of any size, irrespective of the qualifications of those in charge of manufacture No first-class production foreman—and there are many—can, however, hope to handle any reasonable scale of production efficiently, and at the same time undertake planning in its best and widest application Under such circumstances one or both of these highly important activities is bound to suffer Many small companies, whose economics forbid even one individual's being employed solely in a planning capacity, would perforce have to amalgamate this function with others This can be satisfactory provided that such companies do not lose sight of the fact that it is by ability to manufacture correctly that a company largely achieves progress, and that accordingly planning should in their case be kept ever in the forefront, ready to be extended as opportunity occurs

One of the most important things that the average manufacturer can with advantage copy from the mass-producer is the policy of manufacturing correctly With its policy based on manufacturing in step with the best-known practice of the moment, the mass-production concern continues perpetually to seek for improvement in production times through a most vigorous application of time study to all phases of operations and processes, both of a productive and non-productive nature This is, of course, tantamount to a truism often voiced to production engineers and cost accountants alike—namely, “manufacture correctly, and costs will take care of themselves”

Be that as it may, it is surely a fundamental rule of any manufacture, whether it be of a single piece, small numbers, or in the mass, that work be carried out in the best-known way of the moment, with the minimum of effort necessary to produce quality and performance at the cheapest possible price. Although the production of small quantities will naturally forbid the application of many of the tooling methods employed by the mass-producer, it is nevertheless true that the manufacturing methods of many varied types of plants would show considerable improvement as a result of any application of this principle of manufacturing correctly. This would affect different businesses in different ways. In some it would involve the adoption of new and better machining methods, in others the simplification of fitting and erection work to allow simple assembly by unskilled labour. In all types, however, would it make possible the introduction of those often simple, but very effective, labour-saving devices which do so much to make the difference between profit and loss.

There is a fairly widespread belief among small and medium-sized manufacturers that large-scale production owes its success to the use of costly and highly specialized equipment and machinery. This is not so, however. True, many examples can be found where a specially designed machine produces work at a fraction of the cost which would be involved in the use of standard processes, but even so, these are exceptions rather than the general rule. The use of the completely specialized, single-purpose machine in the average, large-scale production factory represents indeed only a small percentage of the total plant. In the main, the type of plant used by the large producer differs little from that used by an equivalent company in a smaller way of business. Where the chief difference does lie is in the use which is made of it. It is, indeed, a proved fact that the large-scale producing concern, given the same amount of labour and identical set of machines as a non-production-minded company, would, nevertheless, as a result of superior organization, definitely outshine the latter and produce more goods at a cheaper price. This point was more than amply illustrated when a large, mass-production-minded company purchased a subsidiary general engineering concern. Here the newcomer's engineers found perfectly good equipment for the purpose for which it was intended, but a complete lack of any real attempt to get the best out of it. Especially was this so in the case of the heavy machinery. On one machine of this type the work was so laborious that it was noted that the operator went home after each day's work completely and thoroughly exhausted and apparently physically incapable of standing any further real exertion. The company's time-study engineers got to work and completely studied the man's daily task. The result was that within a very short time the worker not only considerably increased his output, but had become an ardent playing member of the local golf-club.

Far from being a set-up of purely specialized machinery, the mass-production company does not, indeed, hesitate to resort to the use of even the most primitive methods in order to obtain its results. Following the motto of a world-famous industrialist, "however much away from current practice it may be, if it will do your

job—then do it,” many large producing companies rightly employ the most simple methods possible. Applications of this kind are often a source of surprise and amusement to many. Visitors to one large plant, for instance, are often surprised, and, indeed, slightly scornful to find that a company with such a reputation deigns to use such simple means as holding a certain part in a machine with the equivalent of a rubber heel. It is indeed in the tendency to try to complicate matters on production that so many companies go astray. The golden rule is to remember that the simplest and easiest ways are always the best.

The actual working-speed of any given machine or process serves little purpose, however, if the supplying of material, its fixing ready for working, and the taking away of the finished parts is accomplished in a manner liable to detract from the value of the actual operation-time. Lack of system in this direction is more often the cause of poor production times in the average plant than is the absence of large repetition quantities. The cure can lie in one of innumerable ways, such as by improved lay-out, better material-handling methods, or improvement to tooling or holding of the work in question. The correct answer can, however, be readily obtained by the application of the principles of time and motion study.

The application of this principle in practice brings forth many improvements on production in ways both small and large. It was the cause, for instance, of a decided improvement to the fitting-shop methods of an engineering company engaged on fairly large-batch production of a complete sub-assembly. There being a need in this case for a decided and very quick increase in output, the whole product was subjected to an analysis to discover where the greatest loss of time was taking place. This, it was discovered, was occurring on a preliminary fitting operation, where the fitters had to carry out a considerable amount of work on the body and framework of a fairly large casting. A time study of this process showed that the time taken by the fitters was long, chiefly owing to the difficulty experienced in handling these heavy castings on the wooden benches. This was an appreciable factor both on account of the weight and size of the castings and the fact that, owing to the large number of different fitting operations involved, the castings had to be frequently moved in position on the bench, which on many occasions involved completely turning over. The time study proved that it was largely this inaccessibility of the castings that was the cause of the excessive fitting time, and that consequently, given freer movement, the overall time could be considerably reduced. This was, in fact, more than amply borne out when the use of wooden benches was dispensed with, and in their place were substituted small iron turn-table stands, one to each fitter. These stands, consisting of two simple uprights bolted to the workshop floor and reaching to a height of waist-level, had a reversible centre framework top, on which a casting could be clamped and then turned round between the uprights and held in any desired position. An important feature of the stands was that not only was the centre framework, which held the castings, capable of being rotated in a clockwise or anti-clockwise movement, but it was, in reality, a

framework and, therefore, not solid but hollow. By this means, therefore, once a casting was clamped in position no further setting was necessary, and it could be worked upon, on whatever side required, by simply being rotated, and then locked at the desired angle.

Excellent results were forthcoming from the adoption of this practice. The cutting out of the struggling on the benches with these heavy and awkward castings, and the perpetual packing up with timber and plates, previously involved in the positioning of a casting at a certain angle on the bench, did, in fact, immediately make possible a reduction in fitting time of more than one-third. When finally other improvements were made, and castings were moved by overhead gantry, and tapping and studding, etc., were undertaken by portable air-driven tools instead of by hand, the total operation time became one of forty-five minutes as against the original time of three and a quarter hours.

An application of this kind is by no means confined to engineering. There are, indeed, all manner of works and factories, in a wide variety of trades, who still operate old-fashioned bench-work where this method could be introduced with decided advantage. Its application would, of course, vary according to the size and nature of the product concerned. In some cases the correct purpose would be served by keeping the work stationary, and allowing ease of movement to take expression in the manner with which a worker could pass round it. In whatever form it be applied, however, considerable saving should accrue from this practice of holding work correctly and dispensing with much of this awkward and costly bench practice.

In built-up products the true aim of all machining work should be to manufacture as correctly as possible, so that parts thus produced can be assembled together, rather than fitted. In view of this, and the fact that the machine-shop sets the pace for the rest of the factory, it is of paramount importance that the utmost concentration should be paid to machine-work, with a view to obtaining maximum accuracy coincident with the utmost possible speed. The answer undoubtedly lies in the achievement of the maximum possible amount of fool-proof methods. Often the safeguarding of accuracy by fool-proof methods and the attainment of speedy production go hand in hand. This certainly was the case in a small business connected with the jewellery trade. One of the products of this factory was the equivalent of a small round disc, in which a number of tiny holes had to be finally drilled. This drilling had to be extremely accurate and yet at the same time cheaply performed, owing to the cut-price nature of the trade. The obvious way—namely, by drilling all holes simultaneously by means of a multi-drilling head—was barred on account of the nearness of the holes one to another. So also was punching practice, which the material itself would not allow. Some other method was, therefore, required which would allow the holes to be accurately drilled, but at a speed considerably faster than normal single-hole drilling practice could make possible. The method finally decided upon is of interest not merely as an example of speedy drilling, but more especially because the principles

involved can be equally applied to many other different types of operations in all manner of trades. It was a rather ingenious method, which has since been greatly copied. A small drilling jig, to suit the work-piece, was made and set up on a small, sensitive drilling machine. The jig had a ratchet-feed effect connected direct to the spindle of the drilling machine and arranged in such a way that every time the spindle of the machine neared the top of its upward stroke it automatically turned the jig ready for the next hole to be drilled. To further speed up the process the lever by which the machine spindle was raised and lowered was spring-loaded, so that upon its release by the operator after a hole was drilled it quickly rose free of the jig and up to its highest level. In practice, therefore, the operation was the essence of simplicity and exceedingly fast. Upon release of the lever, immediately a hole was drilled, the drilling-machine spindle quickly shot upward to the top of its stroke, and in so doing rotated the jig containing the work-piece to a position ready for the next hole to be drilled. The operator's task, therefore, apart from inserting a fresh work-piece in the jig as each one was completed, was to pull down the lever continually from its highest to its lowest point. Many times faster than usual practice, whereby an operator moves the jig about by hand and carefully guides the drill into each hole in the jig in turn, it is not surprising that in the case quoted a production of several hundred pieces per hour was obtained.

To manufacture correctly, however, involves much more than the gaining of efficiency in each individual operation and process. It necessitates also that these must be carefully correlated in terms of capacity, so that a correctly balanced plant is obtained. Indeed, bottlenecks—a word which covers so many different types of hold-ups and shortages—are in nine cases out of ten caused purely and simply by the existence of unbalanced plant. Groups of different types of machines may if judged separately be operated most efficiently, but unless the total capacity obtainable from each is capable of meeting the requirements of the others trouble is bound to arise. This takes expression in inability to meet production programmes due to the shortage of some particular item or items. Engineering works, where operations and processes are many and varied, are particular offenders in this direction. Here unbalanced plant—say, for example, in a milling department in relation to all other sections—results not only in hold-ups to many parts requiring milling, but also in the most unsatisfactory state of affairs of having heavily over-worked machinery on the one hand, and semi-idle plant on the other. Conditions of this type can be easily prevented in any business where capacity in total and in part is known. It is indeed essential that these facts should be known, if only from the aspect that no volume of work can be correctly planned, and true delivery dates be given, where the relation between the extent of orders on hand and the capacity of the plant is an unknown factor.

Given knowledge of a plant's total capacity in each different type of operation or process, steps can then be taken not only to remedy shortages or over-abundance in any particular section, but also to ensure the future economical working of the whole.

The well-organized concern accomplishes the latter by means of machine-loading. A production-control section, working to the operation lay-outs devised by the planning department, allocates work to the factory by specifying the types of machines on which each part is to be made. This ensures not only that the best machine is used for each and every purpose, but also that over a period none are too infrequently employed or, at the other extreme, considerably overloaded. In other words, progressive concerns have advanced beyond the practice of allowing the allocation of work to machines to be dependent upon a foreman's memory or his particular brightness at any one moment. That many companies have still to follow suit is obvious by the completely unsatisfactory conditions to be found in so many different types of works and factories. In works of this description advice as to when the manufacture of a certain job can be commenced or completed is more often than not a haphazard approximation based on the blind guesses of the various foremen concerned with the production of the parts involved. That they repeatedly guess wrongly, and that the manufacture of many orders in the works is not only wrongly advised but often completely overlooked, is no indication of negligence or incompetence on their part, but simply evidence of the impossibility of attempting to handle satisfactorily any appreciable volume of work solely from a bunch of work orders and without the aid of any predetermined plan. An even more serious consequence of such conditions is that work handed out in this way is often not only incorrect in its sequence but also in the nature of its proposed performance. Indeed, the fact that work is repeatedly found on the wrong machines is, in the majority of cases, the result of foremen working in this hand-to-mouth fashion, and entirely unsupported by any preconceived manufacturing plan. Faced with the need, for instance, to find work quickly for a number of employees, there is a natural tendency on the part of foremen to allocate work which, although known to be hardly suitable for the machines involved, is given with the feeling that it will at least serve to keep the machines running until matters can be better sorted out.

Although all companies would be well advised to practise machine-loading where this is not an already accomplished fact, care should be taken to ensure that its application is not misplaced. By this is meant that machine-loading should be restricted to its specific purpose of being a means of correctly allocating work to machines and not, as some companies have interpreted it, to employees. While work to machines can be thoroughly and successfully planned, it is not possible to plan work to operatives. This is the foreman's job. He alone, due to his intimate knowledge of the capabilities of each worker under his charge, is in a position rightly to decide which worker should do which job.

Manufacturing Policy

In any known type of manufacturing business it is of the utmost importance that careful attention should at all times be given to the question of what to buy and what to make. Its importance cannot be over-stressed. Indeed, the major difference

between the successful and the highly successful concern often lies purely and solely in the degree of success achieved in this sphere. This is true internationally as well as nationally. In fact, the reason why so many British companies suffer in comparison with equivalent American plants is largely the lesser amount of attention paid to these important points. That this should continue to remain the case is, however, most strange in view of the fact that British companies as a whole do recognize, and, indeed, often pay tribute, to the soundness and efficiency of American purchasing policy. In so doing, however, it would appear that the main point is being missed, and that it is not fully appreciated that the Americans, by concentrating so keenly on purchasing policy, are by no means simply devoting special attention to some side-issue for, say, purely domestic reasons, but are, in actual fact, most thoroughly determining every single item of just what to buy, and what to make.

In American plants the position in regard to these two factors is ever one of constant review. The accepted principle is that the manufacture of any single part in the factory continues only just as long as it remains impossible to obtain it to better advantage from outside suppliers. Conversely a part, or unit, only remains one of procurement by the purchasing department where the works or factory finds itself unable to offer better service. The decision, however, as to whether goods shall be bought or made is at all times dependent upon the service afforded in quality, price, and delivery. As these change or vary from time to time as the result of increased efficiency either in the plant itself or in suppliers' works, so also is the list of items under parts purchasable correspondingly amended. The spirit of competition which by this means is fostered between a given plant and its suppliers is greatly to the good in that it is an ever-feeding factor to the attainment of still greater efficiency by all concerned. Indeed, the fact that the average American plant in driving itself also drives its suppliers proves a source of decided benefit to many a small concern. The result unmistakably shows itself in the innumerable cases of prosperous concerns who owe their general well-being, if not their very existence, to the association with a large efficient company which forced them to put their own house in order and to copy the larger company's methods of eternally seeking for still greater efficiency in every possible activity.

In Great Britain, however, it is rarely that manufacturing policy receives anything like the attention it deserves. As a general rule, purchasing, or at least the sub-contract side of purchasing, is woefully neglected, and instead of being part of a preconceived general plan of what to buy in relation to a company's ability to manufacture, appears to be merely a continuance of an inherited understanding that certain parts only should be acquired from outside suppliers. It is seldom, indeed, that a company—especially where a long-established product is concerned—makes any appreciable change to purchasing and sub-contracting policy, or even fully explores the actual field from which it draws its existing supplies. The result is the constant presence of a group of evils, which in diverse ways seriously affects the economic stability of any business.

Pre-eminent among these, and the direct result of insufficient attention being paid to manufacturing policy, is that form of uneconomical manufacture which expresses itself in the only-too-frequent existence of white elephants, in the shape of foundries, plating departments, tin-smiths, woodworking sections, and the like, with which so many engineering companies seem ever content to saddle themselves. Based on the plea that "the other fellow's profit will thus be saved," these white elephants are often allowed to exist only as a result of complete ignorance of the fact that the motive behind their creation, however worthy, is not borne out in practice, and that the cost of the goods thus produced is considerably greater than that at which they could be purchased from suppliers. That hard-earned profits are so repeatedly squandered in this way arises out of a failure to recognize that the economic production of specialized articles needs not only the touch of the expert, and the knowledge and experience of the specialist, but also the existence of reasonable quantities to ensure production at the desired price level.

Not very long ago the most common type of white elephant, at least in engineering circles, was that of cast-iron foundry practice. Indeed, this became so rampant that a large percentage of companies of any appreciable size did see fit to operate their own foundry. That the practice has since greatly declined has been due to a considerable advance in foundry technique and the consequent realization by the many that only the larger companies concerned with quantity production could hope to satisfactorily compete in this fast-developing, highly specialized field. Even so, however, there are still to-day many medium-sized to small concerns who have yet to follow suit, and who would be well advised as a first move in this direction to check their foundry costs against the prices obtainable from recognized foundries to the trade.

The worst type of white elephant, however, and the one which is most in vogue at the present time, is the practice of running departments covering sections of trades which are utterly divorced from the category of the company's main product. Operated on small-scale production, and often of a very intermittent nature as well as being without the aid of specialized equipment or, indeed, technical supervision, these departments serve no other purpose than to remain a constant drag on the entire economics of any business. That conditions of this type are not confined to any particular trade or pursuit or size of business, but are fairly prevalent in some form or other throughout entire British industry, is attributable purely and simply to widespread failure of manufacturing concerns to view the manufacture of a product in the light of what to buy and what to make. Where this principle is rightly applied purchasing comes into its own, and the consequent dropping of these extraneous manufactures is usually followed by a decided reduction in the total cost of the complete product. Savings in this direction are often most considerable. In a very recent case the result of an overhaul to a company's manufacturing policy reduced the total cost of an expensive product from about £2000 to a final figure of below £1000. The company in this case manufactured a specialized type of machine which, although

basically an engineering product, was, nevertheless, approximately forty per cent wood. It also had many different types of fittings, which involved a fairly large amount of sheet-metal work in the form of trays, guards, etc., and brasswork in innumerable handles, door-knobs, hinges, etc. To manufacture this product the works was set out on an almost self-contained basis. In addition to the normal engineering machine- and fitting-shops the company operated its own foundry, sheet-metal section, brass-

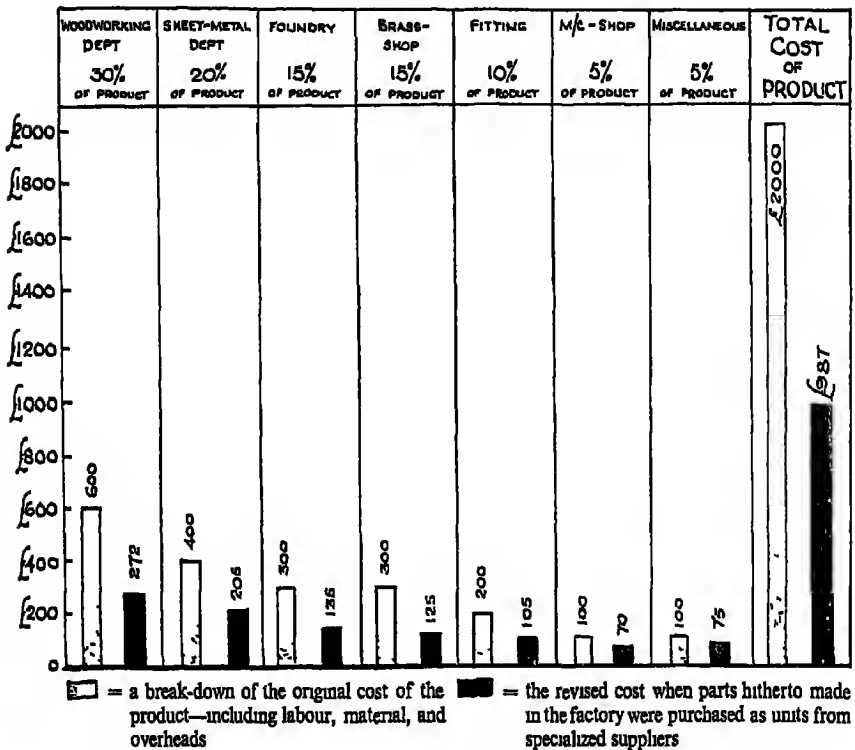


FIG 12 DIAGRAM SHOWING THE EFFECTS OF CORRECT PURCHASING AND SUB-CONTRACTING POLICY

working department, and a fairly large joiners' shop. In fact, so diverse were the activities undertaken in all the various sections of the works that the company manufactured its product practically entirely complete throughout. Purchasing was, indeed, almost completely restricted to raw material, as even the small standard articles, such as brass handles, door-knobs, etc., were made in the works as and when required. It was through an accidental comparison of the works cost of one of the latter small items with the catalogued price of a well-advertised standard article of almost identical design that an investigation was made into the soundness of the company's manufacturing policy as a whole. This quickly showed the existence of a shocking state of affairs. The fact that the company, for instance, in making these small articles in

penny numbers was incurring a cost several times greater than that of equivalent ones on sale to the trade was, although, of course, important, yet in the nature of a minor side-issue compared with the losses being incurred on the manufacture of the heavier stuff. It was here, in the woodworking section, the sheet-metal department, and the foundry, that the chief losses lay, and that the company was incurring a manufacturing cost of several hundred pounds per product dearer than need be.

As in so many other cases of this type the line of attack used to straighten out this faulty manufacturing policy was the construction of primary schedules of what to make and what to buy. As a result of this a decision was taken to purchase on the open market all castings, standard brass fittings, and a large percentage of sheet-metal work, and to sub-let the entire manufacturing side of the woodworking part of the product. To enable this to be satisfactorily accomplished, and in order to provide for the fullest possible exploitation of this policy in the future, the purchasing department was re-organized. The basis chosen was that proved successful by highly efficient engineering companies—namely, a single staff under one head, charged with the acquiring of not only raw material and maintenance parts, but also the whole of the work placed on sub-contract terms, and judged for efficiency according to the degree of success obtained in keeping the factory supplied with goods of quality, at the right price and in time for production requirements. Excellent results were quickly forthcoming from the adoption of this procedure. Especially was this so with regard to the woodworking section. The moves made here were somewhat drastic and involved the sub-letting of the work in sections to a number of highly specialized woodworking factories, leaving the company's joiners' shop to concentrate on the activity it was best qualified to perform—namely, final erection. Right from the very outset this policy proved most successful. The prices at which various companies supplied doors, windows, and many other sections, were such that even the erection of the first product built in this way showed a saving of nearly 50 per cent. of the previous cost. When finally the newly organized purchasing department got into its stride and bought pressings in place of the hitherto hand-made sheet-metal work, purchased castings, and took similar action in respect to a large proportion of the parts previously made in the factory the result was a wholesale tumbling down of costs.

The majority of companies have much to learn from this case. The fact that a company may not be concerned with the manufacture of such a large product or already purchases a goodly percentage of its total does not mean that it can afford to ignore the principle involved. Neither does it mean that a company which at the other extreme purchases nearly all its requirements can afford to refrain from taking periodic stock of its own position in this matter. What is contained in this case—one which, it should be stressed, is merely indicative of so many others—is proof of the vital need for every producing concern periodically to view its manufacturing policy, and ask itself if it is right, by giving just and earnest consideration to its methods in respect of what to buy and what to make.

CHAPTER VI

TRIED AND PROVED METHODS

THE purpose of this chapter, in offering to the reader a number of miscellaneous examples of systems and methods which have been proved successful in a variety of trades and types and sizes of businesses, is an attempt to accomplish two separate and distinct aims. The first of these is to pass on knowledge of what "the other fellow is doing," and secondly, by the choice of examples of as varied a nature as possible, to offer a comprehensive picture of the many and varied ways by which improvement can be sought in any manufacturing plant. That such knowledge is not only desirable but, indeed, vitally necessary was never more apparent than it is to-day. The need for British industry to rehabilitate itself from war production to post-war development as quickly as possible and in a manner which will ensure Great Britain its rightful share of world markets in early post-war years calls for the application of the best possible methods to each and every single phase of business activity. The problem is not just one of transition, for, despite what has been said of Great Britain's war-time production achievements, all is far from well with the organization of a very large percentage of the companies which together make up British industry. Indeed, a general survey of British industry, and an analysis of the efficiency of a representative number of large, medium, and small concerns, would clearly show that the organization of the many leaves much to be desired, and that only in a very small percentage of cases in each group can efficient organization be found. This state of affairs is by no means confined to that vast conglomeration of old-fashioned, ill-kept concerns hidden away in the back streets of badly congested industrial areas which are only discovered by large companies when a harassed buyer goes cap in hand on some occasion of crisis, but applies equally to many companies of repute and even to the so-called national organization. The experience of organizing for production during war-time years proved this point over and over again. Repeated failure to produce quality and quantity to time, or even at all, was the cause of great loss of reputation to many companies who had hitherto been accepted as having considerable prestige and standing. Taken out of their lackadaisical day-to-day peace-time pace, and suddenly confronted by abnormal conditions demanding action at speed and the need to plan, and plan well, revealed organizational weaknesses for which the change in occupation was in no way responsible. It is in the knowledge that such hidden sources of weakness were long existent and, if allowed to remain, must positively prove a bar to the rendering of efficient service in any times, and especially under the strain of keen competition, that attention is particularly drawn to this matter.

The greatest handicap to the curing of faults in many businesses is the fact that where these are most rife so also is the greater the disinclination on the part of the management to even conceive, let alone admit, that any serious faults could possibly exist in their case. If this applies to the more prosaic matters it certainly applies even more to any attempt to persuade such managements of the part that psychology can, and does, play in dealing with workers and production. Even many of the most efficient concerns appear to experience great difficulty in fully accepting the use of psychology in industry as a necessary, or even worthwhile, medium. The result is that many faults which can be cured only by this means are allowed to remain completely untouched and unmoved, despite the expedients that might be tried in other directions. In view of the fact that these attempts at solution prove not only costly and futile in the end but, in the process, are often the means of stirring up all kinds of trouble and even chaos, and, indeed, are often the sole direct cause of considerable loss of confidence on the part of the staff, it behoves all to fully realize that the correct answer often lies not in the use of any system or method but in psychological approach.

Psychology and Production

Ways and means by which psychology can be applied to the achievement of improved efficiency from the actual operation or process within the factory are, of course, many and varied. The application is dependent upon existing conditions and the type of work involved. The general import of the matter can, however, be gathered from the following practical example taken from a colonial food factory. This company operated in an ideally situated suburban position in spacious well-laid-out premises, in which every possible effort had been made to obtain the best possible state of hygiene and temperature-control conditions. Firm believers in well-ordered premises and the utmost cleanliness, from the aspect of both the needs of the product and the effect on workers, the company did everything humanly possible to maintain day by day the best possible working conditions. Despite this, however, and the added factor of exceptionally good wages, the output from a large section of the factory employing several hundred women and girls picking stones and unwanted matter from currants, raisins, etc. was far from satisfactory. Indeed, the output from this section was so much below the expectations of the management and the company's very definite sales' requirements that the problem of how to increase output had been given special attention over a very long period. During this time innovation had followed innovation, as the management desperately sought to strike upon the correct solution. None, however, had the desired effect. Even the promotion of extensive and costly welfare and sports schemes, and incentives in the form of music during working-hours, although producing a seemingly happy and contented working force, failed to increase the production. The time duly arrived when the management, having reached the end of its resources in thinking up new schemes, became thoroughly

discouraged and disheartened, and finally resigned to the belief that they had been expecting too much, and that the very nature of the work was against a large output per person. It was in such an atmosphere that the company, with ill-concealed tolerance, accepted an offer from a company of factory organization consultants to tackle this problem as a test-case, at a charge of nominal expenses only. In accepting this offer the company made it perfectly clear that it would not entertain any suggested improvement which would involve any appreciable capital outlay and that it could not accept any recommendation based on the use of machinery, the use of which, if not absolutely impracticable, was at least highly problematical on a process of such a special character.

It was under such circumstances, and governed by the specified conditions, that an investigator arrived at the factory to study the problem. At first sight conditions seemed admirable and in no way suggesting a low output. The building housing the process was lofty and spacious, well lighted, heated, ventilated, and in every way admirably suited for the purpose for which it was used. The actual process was carried out on rows of long benches, stretching the full length of the department, and at which women and girls were seated at positions nicely spaced apart on both sides. The investigator devoted the first day to familiarizing himself with the work and looking for any conditions likely to effect speedy and continuous output. Not only did nothing appear to be wrong, however, but, to the contrary, it seemed that all essential features for this class of work had been most thoroughly catered for. The benches, for instance, were of the right height, and the employees were seated on admirable stools, which were not only capable of adjustment to suit the height of each employee, but were constructed of a type giving ideal back support. Neither was there any break in the continuity of supply of work. Each employee sat at a bench and was provided with three receptacles—a large one to their left on the bench, containing the supply of fruit, a similar one on their right, to hold the picked fruit, with a large tub by their side on the floor, to hold the refuse and unwanted matter. With lighting ideal, and a complete absence of shadow, there appeared to be not the slightest reason why the output under such conditions could not be tremendous.

The investigator returned to his hotel that night far from happy but resolved to treat the problem in the same way that an ordinary standard process would be treated—namely, by time studying the job over a period. Accordingly for the whole of the next day two average workers, unbeknown to them, were time studied for the full working period of eight and a half hours.

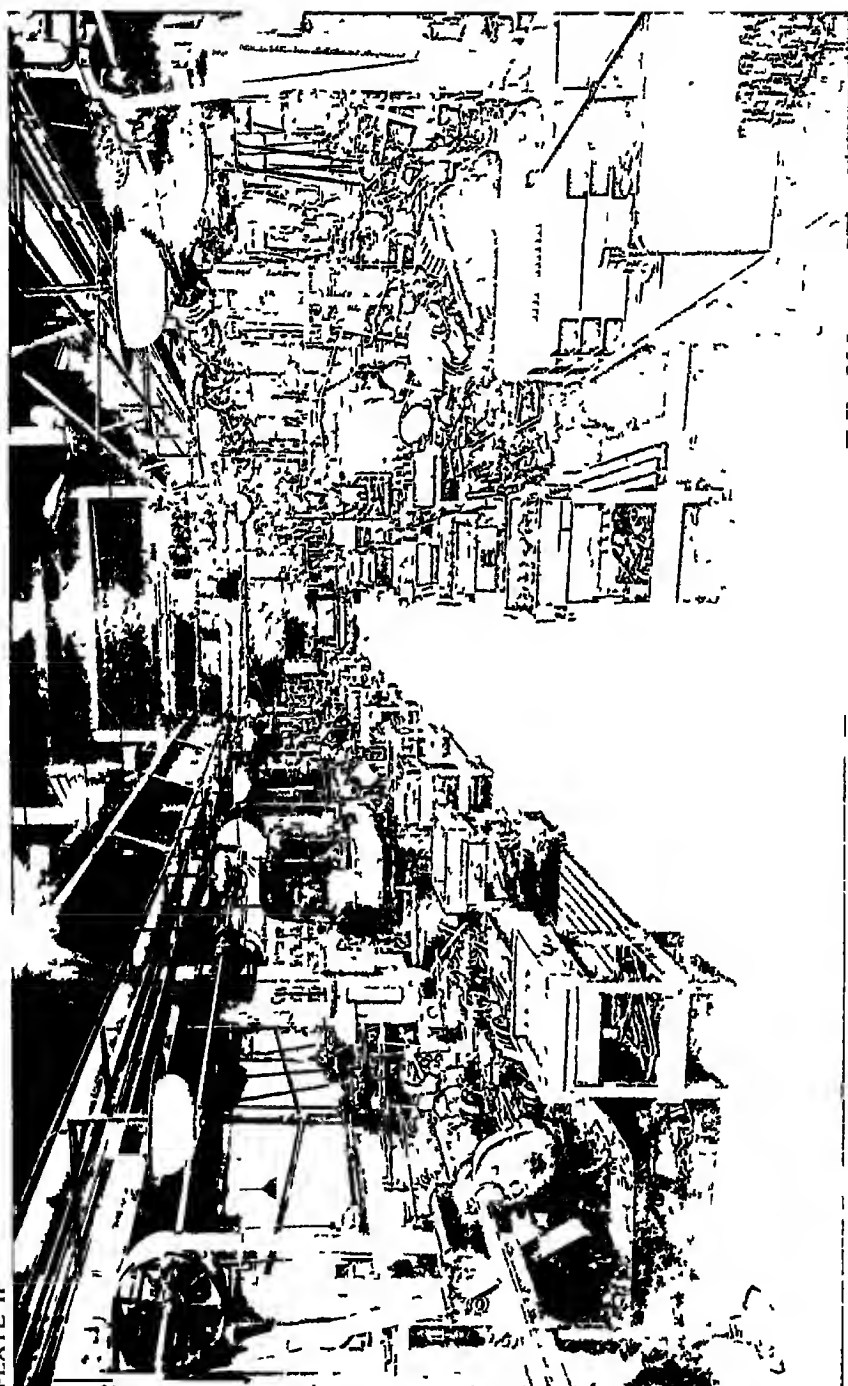
On the morning of the third day the investigator was able to report to the managing director of the company that a solution to the problem had been found. Frankly incredulous, the managing director immediately demanded to know at what cost. This, it was explained, was nil because the solution lay not in the use of new equipment, revised processes, or of elaborate and costly systems, but purely and simply in applied psychology. The cause of the trouble, it was pointed out, had been revealed by the

results of the time study taken during the previous day. This had clearly shown that the direct cause of the low output was the psychological effect on the workers of the monotony of the process, a monotony created largely by workers' inability to observe after a hard-working period any appreciable reduction in a day's set task. Under the existing arrangement employees commenced work each morning full of vim for the day's work, but after working for a couple of hours, and being unable to note any obvious reduction in the amount of work still to be done, they became discouraged, and consequently began to slack off. As the day wore on this slacking increased until the amount of work accomplished during the last hour before closing-time was only a small fraction of that done during the first hour of the day. The cure for this was very simple. All that was required to be done was to supply each worker with a much smaller amount of work at a time. The correct answer, therefore, lay in considerably reducing the size of the trays in which work was supplied to each employee, to fill these only half full, and periodically replenish as each became nearly emptied.

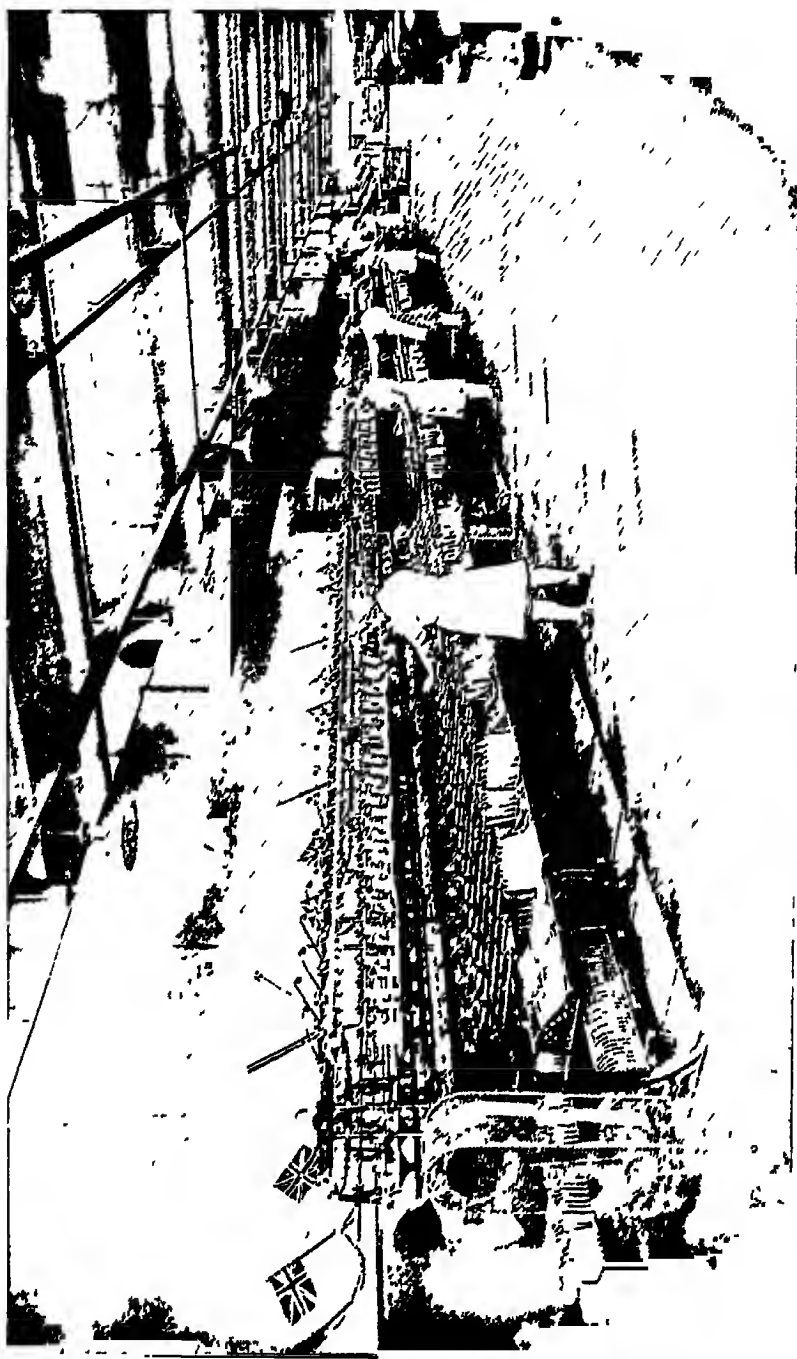
Despite the incredulity of the management, and their obvious disappointment that an alteration of such a simple nature should be deemed a suitable solution to the problem, the suggested method was given a trial. The response was instantaneous. The workers, now able to see clearly the amount of work before them steadily declining as time went by, reacted to the point of becoming extraordinarily keen to clear a tray in the shortest possible space of time. Especially was this so as the tray approached an empty state at various intervals throughout the working day. At these times of the day especially there did, in fact, arise a spirit of keen competition between the workers as to who should be the first to demand the attention of the tray-filler. Under these circumstances it was not surprising that a decided increase in production was quickly forthcoming. This continued to expand week by week until the weekly output at the end of the first three months working of the new system was exactly 87 per cent greater than the highest ever achieved under the old system.

Production Control

Probably no aspect of factory organization is more confusing to the average manufacturer than that part calling for production control and especially the progressing side of it. Such confusion arises mainly as a result of the fact that there are two schools of thought on this subject: one which advocates the carrying out of progressing largely by means of a staff of chasers, and the other which recommends the use of systems for this purpose. In both applications, however, and especially in the latter, the manufacturer searching for the right method is confused by the amount of charts, schedules, and general paper-work which appears to be involved in any given recommendation. Confusion is often made greater by the fact that the information contained on the sample forms with which such systems are usually illustrated often bears little relation to the subject-matter used by the interested party. The picture



A SMALL ENGINEERING WORKS WHICH HAS THE REPUTATION OF NEVER HAVING RECEIVED



A WELL-ORDERED ARRANGEMENT IN A TEXTILE FACTORY

will, however, be made much clearer if it is remembered that the value of any particular, recommended system lies in the principles involved rather than in the detail given with regard to the composition of individual forms. The truth of this will be apparent upon consideration of just how difficult it would be to present a standard system, suitable for a certain size of business in a given specific trade, and to extend it to apply to an unknown number of purely hypothetical trades. Indeed, as no two single businesses are alike, each having their own special peculiarities, no one system, however successful it may have proved in one concern, can be transplanted in its entirety and made to function with equal success elsewhere. It is for this reason that examples of systems should be looked upon as a guide rather than as a set example to follow.

The ideal progressing system is one which restricts the use of both progress-chasers and paper-work to the absolute minimum and tends to operate as automatically as possible. Although there are many obvious difficulties to achieving this in regard to a product composed of many parts, the reverse is the case where the parts are comparatively few. Systems of this type function very well indeed in many branches of the leather trade, in woodworking factories, in many different kinds of soft goods and luxury trades, and, in fact, in all types and branches of trades where parts are few and the sequence and forms of operations are constant and unvaried.

It was a system of this type which was introduced to overcome serious production difficulties in a factory engaged in a branch of the leather trade. The company concerned employed a total labour force of approximately 300 workers on the manufacture of a type of leather case. The trade was, however, of a distinctly seasonal nature, with a set slack and busy period each year. During the busy period, which occupied some seven months each year, the company was veritably deluged with orders for various sizes of goods, all of which specified extremely short delivery periods. It was during these times that the absence of organization to cope with such a rush of orders made itself particularly felt. This was more than serious—it was critical. Indeed, in these seven busy months orders poured in at a rate so far beyond the capabilities of the management to handle that conditions in the factory became nothing short of one complete chaos. In no small measure responsible for this was the action of various officials whose attempts to regularize the position consisted of countermanding each other's instructions with regard to proposed sequence of manufacture. The height of the season found a well-nigh frantic office-staff trying to deal with a colossal number of telephone-calls each day from angry and disgruntled customers all urging immediate delivery of their respective orders, and the factory attempting to manufacture in accordance with this ever-changing advice. The result was that orders in the factory were for ever being stopped, started, and then stopped again, as attempts were made to satisfy the most vehement demand of the moment. The management—forced to do something to improve matters not only from the point of view of delivery and the danger of losing valued and important customers, but also

on account of the serious effects which such constant breaking down of production was having on manufacturing costs—had tried various ways and means of effecting an improvement. That these were, however, entirely without result was due to the fact that the company, instead of directing its activities to secure control of orders, had tackled the position by offering the workers all manner of incentives to achieve greater output. This in itself had an adverse effect because the workers, finding it impossible under the manufacturing conditions to make the necessary grade, were quick to realize the fault as entirely one of management, and consequently with no redress open to them became a thoroughly discontented labour force. This applied even more so to the staff, the composition of which was one of almost constant change as the result of resignation.

This picture of the conditions ruling in this factory is not complete without reference to one other very highly disastrous condition which arose as the result of the complete absence of any form of production control. This was the all-round failure to regulate the supply of material, especially of a non-standard type, in accordance with production requirements. This fault was an outcome purely and simply of the generally chaotic conditions which caused many mistakes to be made in the ordering of material. The result was that it frequently happened that material urgently required by the factory at a given time was found to have been ordered far too late or, on many occasions, not at all. As a consequence of this quite a considerable proportion of the stopping and starting of orders which occurred daily in the factory was not due to attempts to pacify customers but to a suddenly discovered shortage of the right type of material. As certain types of decorative material used on various lines were by no means easy to obtain its sudden shortage often involved considerable delay, lasting in some cases for weeks.

The type of progress system used in this case was finally decided upon only after a careful study had been made of the entire business. This precaution was undertaken not only to assess the routine information on which the system would be based, and likewise to determine the main features for which the chosen method would chiefly have to provide, but also to ascertain the nature and extent of any special features peculiar either to the factory or the trade itself. This revealed that, although the simplicity of the product raised no complications which could not be handled by a simple system directed to perform progressing's normal function of controlling the flow of orders through the factory from the date of receipt to that of final dispatch, there was, however, one feature peculiar to the business which needed special emphasis. The peculiarity, which was really twofold in character, was the direct outcome of the extremely personal nature of the majority of the orders. It involved firstly the need for the office to be more than usually aware at all times of the exact position of each order, and secondly, in view of the seasonal aspect of the trade, and also the cut-price nature of the work, the chosen system would have to be simple and exceptionally cheap to operate. It was, therefore, to cover the outstanding points of controlling the

sequence and flow of work through the factory—making the actual position of all orders at any given moment as self-evident as possible—by simple means capable of being cheaply operated that the system was primarily designed. With this accomplished there remained the important task of deciding the question of personnel to whom the operation of the system was to be entrusted. A most important matter in the case of the introduction of any new system, it was of paramount importance here in view of the general loss of stability which past labour troubles and an ever-

LEATHER CASES			JANUARY												FEBRUARY												MARCH																							
SIZE	QUANTITY	ORDER N°	1	4	6	9	11	13	15	17	19	21	23	25	27	29	31	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31			
1	2 dozen	2406	A	B	C	D	E																																											
1 (SPECIAL)	3 dozen	2407	A	B	C	D	E																																											
2	6 dozen	2408	A			B				C																																								
3	2 dozen	2409	A	B	C	D	E																																											
4	10 dozen	2410	A																																															
5	12 dozen	2411	A																																															

\overline{L} = date on which material is due to be issued from the stores

\overline{J} = specified dispatch date

$\overline{A, B, C, D}$ = the various dates on which each department should begin work on an order

$\overline{A, B, C, D}$ used to denote the date on which each department actually began work on an order—thus showing adherence or otherwise to programme

\overline{S} = actual shipping date

FIG 13 A PROGRESS CHART AS USED IN A LEATHER-GOODS FACTORY

changing staff had brought about. In view of this careful consideration was given as to whether or not in view of past history the question of newcomers to the company was desirable. The decision reached was to train an existing member of the staff to take charge of the new section. The outstanding advantage afforded by this, apart from that already mentioned, was that of having a person not only familiar with the product itself but with the company's strangely assorted clientele. To this end, therefore, the entire staff was placed under review. As a result of this search a very suitable trainee was discovered in the person of a young lady secretary who possessed all the qualities of a good progress chief—namely, a high standard of intelligence, keenness, alertness, directness, and general method mindedness. Most satisfactory also was the fact that this young lady not only had an excellent knowledge of the product and

the general ramifications of the business, but in addition was held in the highest esteem by both customers and work-people alike. Her appointment proved an excellent choice, as she performed her duties excellently. In fact, so well was this done that for many years, assisted only by one junior, she entirely controlled and operated the company's progress department.

The readiness of the system for introduction happened to coincide with the end of a busy season and the advent of a slack one. This considerably eased matters and allowed the change-over to be effected with the minimum of upheaval, and the new procedure to be built up steadily and become firmly established well in advance of the arrival of a further busy period. Had matters been otherwise, and the system been ready for introduction, say, in the early part of a busy season, special steps would have had to be taken to clear up long-overdue orders. This would have been necessary to ensure that the full purpose of the system would have been directed to making a completely fresh start with new orders, without being confused with the outstanding ones and their attendant chaotic state. The fresh start in this case would have been accomplished by achieving the equivalent of a slack period through drastically reducing the number of outstanding orders on the company's books. This reduction would have been achieved in two ways: by sub-letting part of the orders, and by instituting overtime until such times as the leeway had been made up.

The actual progressing system introduced had three prominent features. The first was the use of the 'tear-off-slip' arrangement of works order, by which the position of any order in the factory could at all times be readily assessed. The second covered visible control to denote the general position with regard to orders in bulk, and to ensure that all matters relative to the progressing of orders, such as ordering of material, etc., had been duly undertaken. The third covered the use of piece-work times to ensure correct delivery estimating, and to act as a safety-valve whereby the progressing of orders could at all stages be checked for performance by comparison with the originally promised times.

In practice the entire system operated as follows: all inquiries received by the company were immediately passed to the progress department for the purpose of obtaining a delivery quotation. This was obtained by reference to the progress chart, which showed the date ahead to which the factory was already loaded with orders and, therefore, the earliest date by which a fresh order could be commenced. The estimated date by which a new order could be completed was then obtained by adding to the commencement date the total of the piece-work times involved in a given order's manufacture, plus a fixed figure of three days, which was a general contingency fixed to cover the time taken to issue an order to the factory and the non-productive time incurred in an order being passed from one department to another in the course of manufacture. This information was then passed to the sales department, who advised prospective customers of a delivery date which could be guaranteed provided early acceptance was forthcoming. The progress department on their part kept

records of all delivery estimates thus given, and transmitted these into firm promises as orders were received

Orders as received by the company were passed direct to the progress department. The first duty here was to check the material position. In cases where material was not in stock the buying department were immediately notified and given a date by which it must be to hand. Particulars of the outstanding materials were then entered on the material-ordering list in order that all items could be kept under review and urged where necessary. This done, orders were then entered on the order register. The next step lay in bringing the progress chart to date by including the particulars of the latest order number. With this accomplished orders were then ready for issue to the factory. The works order, which was of tear-off-slip form, was in all cases sent direct to the department named on the bottom slip on the card, which was the department which undertook the first operation. When received in this section of the factory work was commenced on orders in the same numerical order as that given on the cards. The one bearing the lowest number was in each case selected first, material withdrawn against it from the stores, and the order put into manufacture. Upon completion of this department's work on a given order, the slip bearing the department's name was detached and forwarded to the progress office, while the rest of the card was sent with the work to department number two. A like procedure took place in this and all succeeding departments until the work eventually arrived at the finishing and dispatch department with only the top non-removable part of the works order remaining. This was retained by the department until dispatch of the order had been effected, whereupon it was forwarded to the progress office, where its receipt was, in fact, advice that the order had been satisfactorily completed and had actually left the factory. As the tear-off portions were received in the progress office from the various departments from time to time, the number of the department giving the latest advice was recorded in red on the progress chart under the particular works order concerned. This was to enable the progress department to keep check of orders ever in a prominent position, and thus greatly lessen the risk of oversight. This tear-off-slip method of works order served two distinct purposes. By planning sequence of manufacture according to consecutive works-order numbers it clearly showed each foreman and forewoman the order in which work was required, but, more especially, by return of the slips as work was completed in each department it enabled the progress department to see at a glance the position of every order in the works and the progress made at any given date.

The progress department was therefore armed by means of its charts to note on sight all that had taken place with regard to any particular order, and what further steps yet remained to be carried out. The works-order register, for instance, gave full particulars of the type of work involved, the quantity called for, the date of receipt of the order, date of issue to the factory, and the promised delivery date. The material-ordering list showed the dates on which various materials had been requested, the times

at which delivery had been urged, and the dates of actual receipt. The progress chart presented an over-all picture of the total orders in hand, the date by which each one must be completed, together with records of the progress made on each order at any given date.

That orders came to flow smoothly through the factory to a quick and easy finish was the result not only of the procedure laid down by the system, but also the fact that the progress department, furnished with full information appertaining to all orders and having the reins entirely in its hands, was able to urge where necessary as well as to take remedial action as and when required. The need for the latter did arise occasionally when extremely urgent orders were involved. The practice in this case was to give such orders priority over other orders awaiting issue to the works. This took the form of allocating the urgent orders a lower order number than their actual date of receipt warranted. If contemplated action by this means would still not permit an early enough delivery date such orders were issued to the factory with a priority label affixed to the works order, on which was clearly stated the numbers of earlier issued orders awaiting manufacture which the urgent work had to supersede. A strict rule existed, however, that in no case whatsoever was manufacture to be broken down for the purpose of interposing later but more urgent orders. This practice of issuing priority labels for certain urgent orders, was, for obvious reasons, looked upon as a kind of last resort, only to be undertaken in cases of extreme urgency. In course of time, however, orders came to be handled so speedily that the practice largely fell into disuse, and priority labels were not encountered in the factory except on odd occasions at the height of an exceptionally busy season.

Within a very short time of its introductory period the system came to be highly appreciated by both workers and staff. The former were quick to recognize in it a means of ensuring continuity of work and, therefore, good piece-work earnings, while the latter saw the shifting of a great load, and consequently a chance at last of really performing their duties under normal stable conditions. The staff were delighted also that the system quickly showed up faults which they had long tried to convince the management really did exist and were not a figment of their imagination or a stock excuse for failure in any given direction. Chief among these was a slight unbalance of plant between the various departments. Once this was remedied, by the inclusion of a few sewing-machines in one department and the lessening of capacity in another, speed of flow became even greater as the result of each department's new ability to absorb fully the production of the department which served it.

The all-round improvement which was forthcoming as a result of orders being progressed in a systematic manner quickly made itself felt, especially in trade circles. As a consequence of this it was not long before the company began to acquire a reputation for prompt and efficient delivery of first-class goods. This improved as time went on until to-day the company, still operating the same system, is freely acknowledged by all connected with the trade as a company which certainly does 'deliver the goods'.

Storing and Issue of Goods

There exists in Great Britain at the present day an exceedingly wide range of concerns who appear to make no effort whatsoever towards the achievement of systematic storing and handling of goods. This failing is by no means confined to any one particular section or size of business, but is fairly prevalent throughout the entire field of industry. Even many of the larger concerns, of a type which can be classed as reasonably efficient enterprises, appear to look upon their stores as a kind of dumping-ground or glorified box-room. A visit to a representative group of these works and factories would reveal that the receiving, storing, issuing, and dispatching of goods is often carried out under indescribably shocking conditions. That this is allowed to continue is the result of a complete failure on the part of managements to appreciate that such conditions are not only costly in themselves, but, more important still, are a constant source of drag on the efficiency of numerous diverse activities, and especially production. The fault would soon be remedied if managements concerned would commence to take an intelligent interest in matters of this kind and occasionally take the trouble to visit such places as their own stores. An involved investigation need not necessarily ensue, in most cases a first visit of inspection would be sufficient to show the complete absence of efficiency which surrounds the average stores. It would need no special time-study training, for instance, to appreciate the effect on production of workers having to wait long periods at the stores while the store-keepers journey to practically every part of the stores in turn to gather together a few simple parts. Neither would it require any great imagination to appreciate just how it is that the quantities held in the stores at stock-taking times seldom tally with the figures shown on a company's records as the physical stock in hand. From actual observation of this kind it would then be but a step to realize how goods could be better stored, and the receiving, issue, and dispatch of goods be speeded up to a great extent. Better storage would not consist of calling in some manufacturer of metal bins and leaving the entire problem in his hands, because, due in no small measure to the comparatively recent strides achieved in the design and production of these articles, the average actual storage fault is now one of storing sequence rather than of type of container.

In many medium-sized and small concerns the area allocated for stores purposes is either hidden away in some dark corner of the works or at least confined to a very limited space. The result is that marked congestion stands out as a very prominent feature of such places. Much of it, however, is self-made and exists not so much as the result of extremely limited space as a failure to make the best of the space available. Strangely enough where space is most limited—as, for instance, in heavily built-up industrial areas, where the building of even an out-house of the lean-to-shed type is often impossible—floor area is generally used to the least advantage. How to overcome such a limitation and to achieve reasonable efficiency in badly crowded conditions is of paramount importance to the average concern, because, unlike their more fortunate

brethren, the wealthy concerns, the answer lies not in new premises but in ability to make the best of it. As general wholesale warehouses of various types are by no means free from this problem—and the average stores in a manufacturing plant is, when all is said and done, a miniature warehouse—it is proposed to illustrate the obtaining of efficient storing and issue methods under unfavourable conditions by choosing as an example an actual case of reorganization of a wholesale warehouse where conditions of this type were very prevalent. The example is given in the form of the actual report which was submitted by the author to the directors of the warehouse, and which later became the basis on which the reorganization was carried out.

REPORT ON INVESTIGATIONS INTO THE RECEIVING, STORING, AND DISPATCHING
METHODS OF THE ——— WAREHOUSES, LTD

GENTLEMEN,

In accordance with your instructions, we have investigated the methods employed in your warehouse business, and we now have much pleasure in submitting our findings in this matter, together with our recommendations as to the methods which should be employed to rectify the present unsatisfactory position.

To facilitate reference, we have divided this report into the following sections:

- 1 General lay-out
- 2 Goods receiving
- 3 Storage
- 4 Handling and dispatch of orders
- 5 Conclusions

Section 1 General Lay-out

We find that many of your present difficulties are due entirely to the shocking state of congestion which exists in your premises—a condition permitting neither reasonably efficient handling of goods, their storage, or, indeed, the unrestricted movement of the staff from point to point during a normal day's work. Correct lay-out, which is so important in any concern, is expressly so in your case, due to the confined nature of the premises which you occupy and its multi-storey structure. We have noticed that as a result of the lack of an orderly system of storage and established gangways your employees in the course of their duties are for ever clambering over large packages or heaps of merchandise in search of mislaid stocks of small articles, and, when finally locating these, are obliged to spend considerable time removing heavy and lumbering packages in order to gain an inlet to the goods required. As the making of these clearings blocks in turn other points to which entry is required a little later on, a state of affairs exists whereby a large part of the total working time per day for all employees is spent not in the actual making up and dispatch of customers' orders—for which purpose they are primarily employed—but in achieving, during the course of any working day, a complete turn round of a large proportion of the total goods stacked on the various floors of the warehouse. This colossal waste of effort is largely self-made. Its existence, although in some measure the result of poor storage methods, is largely due to poor lay-out, which permits fast-selling lines to be stored at random in most inaccessible places, and often at the farthest-removed points from that of actual dispatch. Consequently workers cover tremendous distances each day in walking to and fro and journeying from floor to floor while engaged in the collection of goods for a given number of orders. The percentage of time lost by

this excessive movement is indeed very large. This was clearly illustrated when a study which we made of a full day's activities of one of your best workers produced figures showing that of the full eight-and-a-half-hour working-day this worker spent one hour and fifty minutes parcelling up and dispatching ten average orders, and six hours and twenty minutes in locating and collecting the goods involved.

We feel that it is not necessary for us to elaborate to any great length on the harmful effects which such conditions have on the general efficiency of your business. We would, therefore, confine ourselves to observing that there is no reason whatsoever why these conditions should be allowed to exist. The premises which you occupy, although far from being all that is desirable, will, nevertheless, permit a reasonably efficient lay-out being arranged—one which, taken in conjunction with points to be raised later in this report, will make possible a decided improvement in results and certainly a complete reversal of the collecting and dispatching times given above. At a later date we will have pleasure in presenting a complete detailed lay-out to cover the whole of your premises and showing suggested itemized arrangements floor by floor, but for the present it should suffice to point out that the basis of this proposed lay-out will be as follows:

- (a) The establishment of recognized gangways throughout the premises by the marking of clearly defined route-lines on the various floors
- (b) The general re-arrangement of storage, with light goods positioned from the top floor downward, and the heaviest goods on the ground-floor, thus gaining the utmost advantage from a service of gravity chutes, which we recommend should be installed on each floor
- (c) The removal of certain partitions and the creation of additional doorways, to relieve congestion and facilitate quick and easy movement of goods and employees
- (d) The storing of quick-selling lines at slightly below shoulder-height level on each floor, and in positions adjacent to the gravity chute (see section headed 'Storage')
- (e) The establishment of a clear line of demarcation between receiving and dispatch by dividing these activities into two separate departments. This, we recommend, could be best accomplished by creating a receiving point in — street, where unloading facilities already exist, leaving dispatch to be handled in the present joint receiving and dispatch section at the opposite side of the building.

Section 2 Goods Receiving

In our opinion it is essential that goods receiving and dispatch should in your case be treated as two entirely separate activities, and, as such, be kept distinctly apart. Your rate of incoming traffic, both in volume and regularity, is more than sufficient to justify the establishment of a separate staff to deal with this work alone. Failure in your case to do so creates needless congestion and hold-ups around a bottle-neck point, and consequently a complete absence of correct flow in one direction. Important too is the fact that the performance of these different types of work at one point by a floating body of workers first on one duty and then the other is contrary to the best interests of production in so far as it prevents that concentration on specific tasks which is so important if workers are to achieve a worth-while standard of proficiency.

Handling facilities for goods receiving are at present very poor. In this direction we recommend the raising of the goods receiving platform to a height equivalent to the height of the standard lorries which serve the warehouse. This will obviate the present need for three or four workers to struggle for a considerable time in order to unload the average

package It will also enable you to improve matters further still by running a roller-gravity conveyor direct from the edge of the receiving platform to a well-advanced point in the receiving bay

A considerable reduction in handling costs would be forthcoming as the result of the operation of an arrangement of this kind Such benefits would be derived through immeasurably improved unloading times, plus a coincident reduction in the amount of labour used for this purpose

Section 3 Storage

We constantly find it necessary to stress to all manner of manufacturing concerns the need for a new and improved outlook on the 'stores' The reason for this lies in the fact that only too often is the stores looked upon as a kind of dumping-ground, rather than a highly important activity which can do much to make or mar the general all-round efficiency obtainable from any given business

If this question be important in a manufacturing plant it is especially so in your case, where the 'stores,' or the receiving, storing, and issuing of goods is, in fact, your entire business In view of this it is essential that the storage of goods undertaken in your warehouse should be such as allows free and easy access and is best suited to facilitate rapid collection

As a move in this direction we would strongly recommend the housing of goods in suitable bins and containers in place of your present unsatisfactory method of storing all manner of articles on plain, flat shelves and single-tier table-tops This would not only enable a more orderly arrangement, but would help considerably towards obtaining a much greater use of the floor-space at your disposal Lines of bins, running practically the full length of each floor, and spaced suitably apart to permit of spacious gangways between each, would be capable of housing at least 50 per cent more goods per floor than your present maximum, and would at the same time provide the means whereby goods could be arranged and classified in an orderly manner

The latter is, in our opinion, most important, because we believe that it is very unsound practice for stores and warehouses to be entirely dependent, as they so very often are, on the personal knowledge of some long-service member of the staff for the correct interpretation of customers' orders and the description and location of the goods concerned

As this information should be entirely self-evident to even the newcomer and youngest warehouse-hand in your employ, we would recommend adoption of a system of visible classification which has proved its worth in meeting similar conditions on many occasions in the past In practice it is simple yet extremely effective It involves the classifying of each block of bins with an alphabetical symbol clearly stencilled at both ends of each block, and the consecutive numbering of all the bins, so that, for example, certain goods could be referred to as being held in A49 bin or B147 bin With this done, and goods allocated and stored in the respective bins, a weather-proofed schedule is then placed at the ends of the blocks of bins, giving a list of the bin numbers contained in a block, and detailing against each a description of the goods contained therein A very elementary arrangement, it nevertheless serves the twofold purpose of making mislaid stocks a thing of the past and the location of goods evident to all and not dependent upon the presence of some long-service member of the staff

In order further to facilitate this locating, and at the same time restrict unnecessary movement, it is necessary to pay considerable attention to the actual position at which various types of goods shall be stored The ideal arrangement is that undertaken in finished-part

stores in certain engineering factories, where parts are so stored in sequence that one part each from a given line of bins, say from bin No 10 to 92, automatically gives a complete set of parts for a certain product, despite the number of parts and quantity required of each particular item. The advantage of such an arrangement is not only speedy collection, but the fact that a complete stranger, without any knowledge of the work, and completely unaided by documentary advice, can easily and unfailingly collect a given set of complete parts. A careful study of your orders over the past three years has shown us that this system can be applied in its entirety with regard to some 30 per cent of your present turn-over. For the rest, we recommend that goods be stored on a basis of like kinds together, with the faster-moving lines at a height approximately of shoulder-level.

Section 4 Handling and Dispatch of Orders

Given the rearranged lay-out, with its revised allocation of goods to the various floors, the order office would be furnished with a chart giving full details of this information. This would enable the office to ensure that future orders upon being issued to the warehouse would be sent direct to the highest floor in the building from which goods would have to be withdrawn in order to complete any particular order. By this means collection of orders would not fluctuate between the various floors in turn, as at present, but would become one of progression downward by means of the gravity chute.

We most strongly disapprove of your present method of workers operating as joint collectors and packers. A division of these duties is absolutely essential. The arrangement we recommend is for only collection to be undertaken on each floor, leaving final packing to be carried out as a concentrated activity in the dispatch department on the ground-floor in a position adjacent to the delivery end of the chute.

For the actual process of collecting we recommend the use of containers, in the form of baskets, to be carried suspended in front of a worker, and held in position by means of a shoulder-strap. This would enable employees to carry a far larger quantity of goods at a time, and consequently considerably reduce the number of journeys at present involved in collection of the average order. Goods as collected would be passed to a central-receiving-point on each floor, from whence orders, after being checked, would be dispatched in chute-carriers to the next floor concerned in an order or direct to the dispatch section on the ground-floor, as the case may be.

Work in the dispatch department itself can very easily be made into an exceedingly fast, sectionalized routine. This would best be accomplished by installing a roller-gravity conveyor in continuous "U-shaped form," back and forth across the department, and carrying out sectionalized packing operations in progressive sequence at succeeding stages on the conveyor. Still further simplification could be achieved by instituting improvements such as the use of gummed labels in rolls suspended in front of workers instead of the present use of separate labels, to obtain which frequently involves considerable searching to be undertaken in heavy and unwieldy bench-drawers. Other moves in this direction would include the use of mechanical aids in the form of quick-measuring and cutting guillotines for paper, string, etc.

Section 5 Conclusions

During the course of our investigations into your warehouse practices it became abundantly clear that the primary cause of your inability to dispatch orders to time, and at a reasonable cost, was one of lack of requisite order and method.

92 WHAT'S WRONG WITH YOUR FACTORY, OFFICE, OR WORKS?

The recommendations which we now submit tend to show how, with the minimum of capital outlay, you will be able to overcome such conditions, obtain the maximum possible use of your premises, and by means of the introduction of simple systems and methods, organize to achieve a far greater turnover than at present lies in your power. Indeed, so confident are we that we have correctly diagnosed the faults and suggested the right remedies that we are prepared to guarantee a 400 per cent increase in turnover from your existing staff within six months of the new methods being adopted.

In conclusion we would advise of our readiness at all times to wait upon you and discuss any aspect of this report on which you would like further details and information.

We are,

Your obedient servants

The methods as outlined were duly introduced into the warehouse under the terms of the guarantee. Six months later the weekly turnover, which was still rising, was acknowledged as being exactly 576 per cent greater than the highest weekly turnover achieved during the twelve months before the reorganization.

When one considers the wide extent of subject-matter involved in the thousand-and-one different propositions which comprise the normal day-to-day activities of the average factory it becomes obvious that to quote any comprehensive range of tried and proved methods would prove a tremendous task. Even were this practicable it is extremely doubtful if any real purpose would be served, because, when all is said and done, the seeker for the ready-made system really seeks in vain. He is, in fact, doomed to disappointment because, with the needs of each individual factory being more or less peculiar to itself, no system, however successful in one factory, can be transplanted in its entirety and made to function equally as well in a different environment and amid widely different conditions. Questions of size of factory, types of personnel, peculiarities of the manufacture itself—these and many other factors all play an important part in determining the suitability of any one system or method. What does remain constant, however, is the principle involved. This is true of any manufacturing enterprise, whatever its size or type of product. Given appreciation of this, the adaptation of a known system, or even the formulation of a new one, need be a matter of small moment to the average business-man. The main concern, it should be stressed, is to achieve full understanding of the principles underlying the use of known, successful systems and methods employed on varying classes of work, and whose presence is essential to the attainment of efficiency. It is for this reason that the examples given in this chapter have been chosen more for the different types of principles involved rather than for any claim which they may have to being complete and self-contained systems and methods.

CHAPTER VII

AIDS TO PRODUCTION

IT would perhaps be well, in commencing to deal with ways and means of aiding production, to first discuss how not to do it. Production, which can be furthered as the result of direct approach to the job itself and by the use of systems, can also be helped to no inconsiderable extent by very indirect means. It is in this latter field, where assistance can be forthcoming in such a diversity of ways, and by activities apparently only remotely connected with the point at issue, that so many companies go astray. Due in many cases to an excess of zeal, as well as a complete lack of psychological understanding, companies introduce methods which, although directed in all good faith to the sole purpose of facilitating production, do, in fact, actually have the reverse effect, and by proving a constant source of irritation to all and sundry serve no other purpose than unwittingly to retard the very thing which they were devised to assist. Some of these are not without their humorous aspect. Foremost among moves of this kind was the action of a fairly large company who, in seeking to devise ways and means of aiding production, pursued the angle of attempting to force men to stay on the job. Thoughts on these lines eventually led to the firm conviction that the company's entire production troubles would be solved if only the men could be stopped from retiring periodically to the lavatories for a smoke and a rest. The lavatory question, therefore, became priority number one on the agenda of all management meetings for some considerable time. The eventual outcome was startling. Early one Monday morning a gang of mill-wrights descended on the lavatories and commenced to remove all the cubicle doors. With this an accomplished fact, an even greater surprise came in the appearance of a gold-braided watchman, whose sole function in life was to stride continually up and down the full length of a lavatory in order to keep an eye on things. That he did this most thoroughly and in so doing by no means limited himself to keeping an eye open for smoking but included the taking of notes on the number of visits paid, and the time taken on each occasion, became not only a source of great irritation to all the men, but one of acute embarrassment to those of a superior type. Despite the utmost representations on the matter from the best type of workmen, the management remained firm in its decision not to countenance any change, and for some twelve months, even in the face of a thoroughly disgruntled labour force and a much lower production, persisted in applying this method of aiding output.

The type of company which operates practices of this kind to-day would doubtless, and in all sincerity, be prepared to justify its actions on the grounds that it has long

operated in such a manner and, instead of feeling any adverse effects, has, in fact, gained decided advantage from it. Any such claim, however, would not bear investigation. Somewhere in the organization—either in direct achievement, in costs, or in some hidden manner—would be found the result of workers' expression of their intense dislike of methods considered ill-conceived, antagonistic in nature, and a perpetual source of irritation.

Equally unsatisfactory, however, are the actions of many companies who go to the other extreme in attempts to aid production by indirect means. In this vein was the action of a company engaged in running a large, war-time scheme, which, upon suddenly discovering the advisability of making morning tea available to all workers, decided to do the thing in real style. The result was that a visit to this company at almost any hour of the day found complete batteries of machines standing idle, while operatives were hanging about in groups round innumerable trolleys in various parts of the works, from which uniformed attendants sold tea, tobacco, cigarettes, sweets, and chocolates, and even fruit when this was available. In view of such methods, it was not surprising that this company had probably the poorest war-time production record of any concern in the country.

Indirect methods, in order to have the correct effect, must be basically sound. Given this, a most appreciative effect on production can be obtained. Methods of the right type are innumerable. These can be either of psychological appeal, as, for instance, in the case of visible results and exhortations prominently displayed, in the form of a suggestion-box, with its twofold purpose, of a welfare character such as interest in business services and housing matters, or of that type of move more closely connected to the actual job, examples of which are offered in the following section.

The Indirect Way

A medium-sized engineering company, producing a standard article for the trade, was far from happy on its manufacturing side, where there was a constant and unvarying need for a considerably faster-produced output. Steps taken by the management to remedy this had followed the line of direct approach and had consisted of revised tooling, improved machining, the introduction of various types of systems to handle small-batch quantities, and, when all these had failed, the introduction of incentives in the form of most attractive bonuses. Despite these, however, and many other similar attempts, the problem remained unsolved. It continued so until a newcomer, being satisfied in a general sense with the soundness of the actual manufacturing methods employed, sought for the cause in the field of matters only indirectly concerned with actual speed of production. He was quickly successful, for in a section of this field—namely, in the organization of the inspection department—was both the cause and solution readily found. The fault was one purely and simply of delay and hold-up.

to production through parts awaiting inspection. What was happening was that the average order, composed in the main of exceedingly small quantities, was being produced faster than the set-up of the inspection department allowed it to inspect. Consequently the latter department, which was arranged in the form of the old-fashioned view-room, was literally stacked out with pile upon pile of work-trays, each containing work awaiting inspection. Under these circumstances the wrong orders were attended to first, with the result that those at the bottom of the piles only saw the light of day after a considerable waiting period, which in the majority of cases was often as long as three weeks from the date of receipt from the works. Had this delay been the full extent of the trouble matters would have been serious enough, but the position was, of course, made much worse by the fact that attention, even when given, was no guarantee that the work would be accepted. Indeed, seeing that the inspection department had necessarily to be exceedingly minute with this class of work, and as a result regularly rejected a very high percentage of the total parts produced by the machine-shop, a position existed whereby a large amount of the work produced stood awaiting inspection for some two to three weeks only to be finally rejected and sent back for rectification or complete replacement. Arrival at this stage saw still further delay before work could even be put back on the machines, and certainly before the parts were made anew and returned to the inspection department again to await their turn for inspection.

With these facts ascertained it was obvious that what was required was a drastic reduction in the time-cycle taken by the average order. It was equally obvious that the cure lay not in extension to the inspection department and the engagement of additional inspectors, but in carrying inspection to the actual job itself, and, by thus carrying out a policy of "prevention is better than cure," taking every possible precaution to ensure that work would be made right in the first place, and so avoid having to wait weeks only to be finally told that it was incorrect.

The actual system introduced into this factory was, in fact, this line-system of inspection. Under this arrangement the final view-room was dispensed with, and the staff was dispersed to positions on the actual production lines in the factory. Each line of machines was equipped with 'floating' floor inspectors, whose duties were to travel up and down a given line of machines and check the 'first off' of each part produced, and thereafter to move constantly from machine to machine on the look-out for any alteration to machine setting which could cause variation in the set standard of accuracy. In addition to this each line of machines was also equipped with its own final inspection point, usually positioned at the end of each line, which carried out final inspection of the finished parts produced on the line, and from whence, upon acceptance, the parts were sent direct to the finished-part stores for later issue to assembly. The value of a system of this type soon made itself apparent in the greatly enhanced production which came as the result of this cutting out of delays and the ensuring of accurate production in the first instance.

Many different types of factories which operate the final view-room method of inspection would do well to copy this much better system. The fact that hold-ups to production in their case may not be as pronounced as in the example just quoted should not act as a deterrent. Even where varieties of orders are few, and a given view-room can reasonably cope with work on hand, the method is still costly and inefficient. It fails not merely by reason of the expense and delay involved in moving goods to and from production, but more especially in that it does not cater for the preventive aspect, which is the outstanding feature of inspection on the spot.

In order fully to appreciate just how far prevention of faulty work can be carried one has to delve into the secrets of the 'line' system as operated by the best mass-production firms. Here, despite the apparent openness and simplicity of the system, many features remain hidden to the uninitiated. It is far from widely known, for instance, that much of the ease of production on the line system is in no small measure due to the fine link-up between inspection and production. Inspection, indeed, does in reality become a case of prevention on the spot, not merely concerned with the saving of time lost under view-room practice, but going much farther than this, and, while primarily safeguarding quality, yet at the same time using inspection as a means of facilitating production. The aim in view is the complete elimination of scrap, and especially of parts on which many operations have been performed. The means employed is the ensuring as far as is practicable that each succeeding machine-line operation uses the previous operation's inspected and approved machined surfaces as locating points for its own jigs and tools. Firms of all sizes would do well to study this practice because, while the necessity for keen inspection does not inevitably result in heavy rejection, it is, nevertheless, only by the promotion and development of the fool-proof process that the best aims of production can be served.

It was a Scandinavian engineering works which supplied an example of one of the best ways of helping production by indirect means. The subject-matter in this case was that highly debatable one of rate-fixing. This Scandinavian concern had progressed far beyond the practices of more industrialized countries in this matter, and, instead of confining itself to bemoaning the dearth of good rate-fixers, had decided to do something about it. This took the form of running a school in the works where practical rate-fixing was taught. The school maintained two different classes: one which was a kind of refresher-course for keeping the company's rate-fixers up to date, and the other which was used to train selected apprentices to become the company's rate-fixers of the future. As a result of this the company's standard of rate-fixing in the shops was outstandingly good and had become the envy of many less progressive-minded concerns. Not least important of the benefits obtained from training rate-fixers in this way was the fact that, although the prices were most keen, there was a complete absence in the works of that form of bickering between men and rate-fixers which is so prevalent, for instance, in works and factories in Great Britain. This

PLATE IV



AN EXCELLENT ARRANGEMENT OF A SMALL FOOD-PACKING UNIT

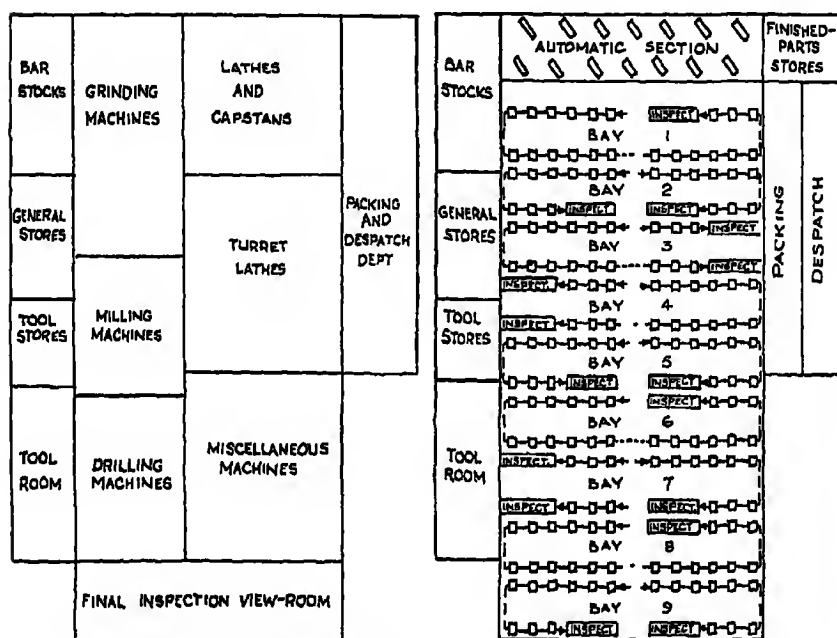
PLATE V



EFFICIENT LAY-OUT IN A LARGE BAKERY

was entirely the result of the 'personal' aspect of the scheme, which, in taking apprentices in the same way as for the trades of fitting and turning, etc., had, in effect, established rate-fixing as a definite trade practice, thereby making workers 'accept' it in the fullest sense of the word

The result of a wager—made between an industrial consultant and a managing director of a medium-sized upholstery factory provides added proof, if this be needed, of the important effect on production of a clean or untidy shop. The director in this



An Engineering Works with Final View-room Inspection under Departmental Layout

The Same Works rearranged for Line Inspection and Production Flow

FIG 14 LINE INSPECTION VERSUS FINAL VIEW-ROOM PRACTICE

case, like so many of his type, was firmly convinced that the case for clean and tidy conditions in the factory was nothing more or less than one of sheer, gross exaggeration. Reasonable cleanliness, he contended, was, of course, necessary, and was, in fact, carried out, but to wish to go further than this was nothing but highfalutin theory, which, although possibly meritorious for its moral and virtuous value, was, nevertheless, completely miscast in its proposed application to actual working conditions in a factory. It was to prove or disprove this view that a wager was made. Under the terms of the wager the claim in favour of a clean shop was to be put to the test in a fully practical way. For a full six months the shops were to be maintained in a manner specified by the consultant. If at the end of that time no appreciable improvement in production

was forthcoming the consultant was to bear the whole cost of the expense incurred by the additional maintenance charges, as well as to pay the managing director a certain fixed sum. On the other hand, however, no reverse payment was involved in the event of the managing director's losing, because the consultant, on his part, was quite satisfied to rely on any advantages which may accrue professionally as a result of the wager going in his favour.

The commencement of the trial period saw the shops thoroughly tidied up and put into a reasonably clean and orderly manner. Maintenance of these conditions from that date onward was by no means excessive or in any way over-elaborate, but well within the extent to which the average, efficient company normally maintains its working space. At the end of the six months a reckoning was taken. This proved the consultant to be an easy winner, because the output of the factory was exactly 13 per cent greater than that before the introduction of the better working conditions. More important even than this, however, was the fact that the new conditions had also been responsible for producing a marked improvement in the quality of work produced in the factory.

By Systems

Observant visitors to most engineering plants, and certainly the large ones, are often astonished to note the considerable amount of walking about which workers indulge in, and which, according to all intents and purposes, appears to remain completely unnoticed by the management. Although such casual observations may to some extent magnify the position, it is, nevertheless, true that the average concern does lose a considerable number of man-hours per week, owing to this loss of time in walking to and fro. A census recently taken in this connexion in a certain large factory is of the utmost interest. This showed that the total loss per day to the company from this walking about of workers amounted to 12.3 per cent of the total man-hours available per day. This condition, which is a striking reflex on the efficiency ruling in the plant in question, is, however, by no means an isolated example. Unfortunately it is only too truly representative of the state of affairs found in so many plants at the present day, where loss of time due to unnecessary walking about is generally high, and in many cases even far in excess of the case quoted. Investigation has shown that this is due to a variety of reasons, which vary in intensity according to the type of plant concerned. In some cases poor lay-out is the sole reason for this unnecessary walking about. In others the fault lies mainly in supervision of an exceedingly poor type. On the other hand cases have been found where it has been an instrument used by the workers to hide ridiculously high piece-work prices. In any one reasonably organized plant, however, probably the chief cause of this loss of valuable man-hours lies in the method—or lack of method, to be correct—of supplying tools to workers on production. Indeed, a check taken at the tool stores in the majority

of plants will supply astonishing figures as to the amount of time lost per day by skilled workers in withdrawing and returning tools to the stores on the tool-check system. Even the best of plants are not free from it, where, strangely enough, despite the utmost endeavours to seek continually for improvement, to achieve split-second production, and to devise and operate the best possible systems to aid production, the stores remains completely neglected and, as a result, still operates for all practical purposes under exactly the same conditions as it did fifty years ago. This is all the more surprising as a large number of companies have already made undoubted strides in this direction. The type of method used in these cases, of course, varies according to the conditions operating in the factory, but, generally speaking, they are of the type given in the following example.

A certain medium-sized engineering company, manufacturing a variety of products under small- to medium-sized batch production, held an undoubted reputation for being a highly efficient organization, especially famed for its time-study activities. There came a time, however, when the company arrived at the definite conclusion that much of its time-study efforts at the actual machine and bench, where improvements in even split seconds were for ever being sought, were illogical while unchecked causes of considerable loss could be found within the complete framework of operations of which the actual machining or fitting operation was only a part. A study of a wide range of jobs had revealed that, while most of the actual machining and fitting operations had been brought to a high standard of perfection, considerable loss was, nevertheless, occurring in both classes of work, owing to workers having need to make repeated journeys to the tool stores in order to obtain necessary tools. Although it was realized that this was treading on entirely new ground, it was, nevertheless, felt that something would have to be done to ease the position, whereby exceedingly fast operation times for 'short runs' were being offset by losses in this direction. It was found that the extent of these losses presented more than ample justification for such a move. On the average machine-shop order—which was one of fairly small quantities, and involved frequent tool changes to cover a wide range of operations—the loss incurred in this way amounted to as much as 10 to 15 per cent. of the total over-all time. In the fitting-shops and the machine tool-repair section the loss was even greater. Here work was one of almost constant procession to the stores. This was found to be due to the fact that the workers in these sections had constant need for considerably more tools than could be obtained by the ten tool-checks with which each worker was issued. Consequently workers were forced to return certain tools in order to obtain others, even although the returned ones would be required very soon afterwards.

From the first attempts to rectify the position it was decided to treat the machine-shop and the fitting-shop as two separate problems, and to deal with each in turn. The latter department, as representing the greatest loss, was taken first. The answer here, it was felt, lay not in supplying each fitter with a full kit of tools. This would

not only greatly increase the risk of loss by pilfering, but would also cause considerable duplication of both costly and also infrequently used tools. Such a method, it was reasoned, could only be recommended in part and not in its entirety. The actual system introduced did, in fact, allow for this. It was a combination of two methods—the supplying of each fitter with a part-kit of standard tools, such as files, hacksaws, etc., leaving the securing of all other tools to be undertaken by means of a tool-progressing system. The latter was the essence of simplicity. Over each fitter's bench was positioned a small disc, painted red on one side and yellow on the other. The red denoted that a tool was required, and the yellow that a tool was available for return. A worker requiring a tool would turn the disc to show red approximately fifteen minutes before he would actually need it, whereupon a small boy, employed to watch for these signals, would call for particulars of the tool required, and in due course deliver it. Conversely he also watched for yellow signals, indicating tools ready for return. The latter signal was especially useful as it kept tools in good circulation, and, in practice, meant that the stores was rarely troubled, as the needs of any one fitter could more often than not be instantly met as the result of knowledge of availability of the said tool on some other bench.

The system met with even greater success than was anticipated. Hundreds of man-hours of skilled workers' time were saved each week at a cost of one small boy's full-time employment. In addition to this not only was good circulation of certain key-tools effected, but periodic search for mislaid and missing tools, a frequent ritual in most engineering plants, did, indeed, become a thing of the past. The effect of all this showed itself on production in no uncertain way.

The machine-shop problem was overcome by the introduction of a system whereby tools were supplied to the machines at the same time as the raw material. Each machine-operator, upon being supplied, therefore, with tools and material jointly, had everything in readiness for the completion of the work in hand, and consequently had no occasion to leave a machine. The actual system operated as follows. Tool symbol numbers were recorded on each production-material issue-card. When material was withdrawn from the stores against an individual card the material and the card were passed to the tool stores, where, from a tool-lay-out sheet correspondingly numbered, the necessary tools were issued. This fact was then initialled on the material card, and the material and tools were passed to production. Here the tools followed the material stage by stage through the various machining operations and inspection points. At each of the latter inspectors withdrew the tools used for completed operations, and after inspection returned these to the tool stores. This inspection of tools was most valuable, in that inspectors were able to advise of tools needing regrinding or conditioning before being used again, as well as being in a position to suggest possible alterations and modifications to cure faults found during manufacture. The last machining operation completed, the remaining tools were returned to the tool-stores, while the completed finished parts were forwarded direct to the finished-part stores.

A system of this type, which rendered excellent service in this case, can be adapted to serve with distinct success wherever there is reasonable repeat quantities of a fully tooled, small article. Its best use, however, lies in its application to deal with the complicated tooling position which arises on batch production in a machine-shop where the same plant is used to produce repeat orders on a variety of small to medium-sized products.

Drastic improvement to the production of an electrical engineering company, employing some 300 hands, arose out of a very small beginning. One day the managing director of the company had occasion to walk into the general stores. What was to have been a quick walk round developed into a probing search to discover the full extent of the very obvious excessive stocks of material which the stores carried. This showed such a large amount of material for so small a company that he carried on with a tour of inspection bin by bin, in order to discover just what was in each one, and why. It was not long before it became clear that the fault lay not in over-stocking of any one particular item, but in the multiplicity of types and sizes which the stores carried for practically every part. A case in point was that of bolts and screws, where for nearly every size of diameter these were stocked in lengths varying only by one-eighth of an inch.

Next morning a conference of all concerned was held in the managing director's office. The purpose of the meeting, it was explained, was to secure a drastic reduction in this multiplicity of types and sizes, in order that the company would not be called upon to tie up such a large amount of capital in stock. The meeting progressed well until an argument arose between the chief designer and the production manager as to the extent to which the proposed reduction of types and sizes could be pursued. It was then that the true state of affairs came to light. The real problem, it transpired, was one of much greater importance than the mere limiting of multiplicity of parts in order to secure reduction in the amount of capital tied up in stock—although worthy as this doubtless was—and really evolved into a distinct need to progress much further than this, in fact, to secure complete standardization of design. This was necessary because this multiplicity of types and sizes also applied to a very large proportion of the parts made in the factory—a factor which, in innumerable ways, tended to the all-round complication of production. By no means least of these was the fact that this total disregard of standardization had allowed designs to come into being which were complicated in the extreme, and which, therefore, proved a perpetual source of trouble from a manufacturing point of view.

With it being obvious from a study of the designs of the various products that the advantage to be gained from applying standardization could be considerable, a decision was taken to so proceed. As a first move in this direction lists were drawn up of all the parts used in the company's range of products. These were subjected to a careful vetting, with a view to obtaining the maximum number of items common to more than one product. As a result of such a scrutiny it was found possible, by means of

various slight alterations and modifications, to produce many such common parts. With this accomplished, and a considerable number of items thereby eliminated, the standards thus chosen were given an even keener review in order to obviate unsatisfactory features of design which were causing difficulty in manufacture or involving the use of freak sizes in such items as screws, bolts, washers, etc. As standards became finally determined, schedules were compiled to cover each of the various categories of parts and items concerned. These schedules gave a full description of the parts, as well as complete details of where they were used. Screw schedules, for instance, listed the complete range of screws used, and against each type and size recorded the part numbers of the items to which a given screw had been allocated.

To-day this company, which has made remarkable progress largely as a result of the general all-round economies and aids to production derived from this strict application of standardization, has a book of schedules of standard parts, which is indeed the Bible of its design department. It is in almost constant use from day to day, being repeatedly referred to as alterations and new designs are proceeded with. So strictly safeguarded is this matter of standards that the creation of an additional standard is indeed only undertaken as a last resort, and even then only with the personal authority and approval of the head of the department.

By Methods

The cotton industry, and, to a lesser extent, the coal-mining industry, would not have been in their present-day, unsatisfactory state had attempts been made in the past to provide an equivalent to the "Methods Man," who occupies such an important and prominent position in the organization of the really efficient, go-ahead engineering concern. Companies in the latter category are fully alive to the very positive fact that no industrial undertaking can afford to stand still and perpetuate the same methods year after year, because the future prosperity of any industry or individual plant, and, indeed, even its very existence, rests upon some measure of progress being made from time to time. Progress is, indeed, the life-blood of any organization or industry. Those who achieve it in large measure become the highly successful concerns, and conversely those who achieve it not at all seldom last long in open and unfettered competition. It is in methods used, and not rates of pay, where lies the deciding factor of success in open competition. It is because of this that the large well-organized company is able to pay higher wage-rates than equal but less organized companies, and at the same time produce at a far cheaper price. Naturally production quantities play no small part in enabling the large producer to outshine those in a smaller way of business. Even so the small and medium-sized producer should never forget that demand for goods follows the production of cheap, good-quality articles, not the other way round. The large producers of motor-cars and radio, for instance, owe much of their success to the fact that they themselves largely created the demand for

their own goods by organizing themselves to produce quality at a price within reach of the many. Such a highly satisfactory state of affairs, however, is only reached as a result of continued, steady progress on sound, efficient lines. The way is hard but not beyond the means of even the most humble business, as witnessed by the fact that few large companies commence as such but as a rule rise from most humble and even obscure beginnings.

The would-be progressive company must, however, commence by putting its house in order to the extent of first manufacturing correctly, and thereafter relying for progress through the continual seeking for improvement in all branches of the business, but particularly in ways and means of securing better and still cheaper production. How to produce more cheaply and with better value for money must ever be the watchword of such a company, constitute its aim, and, indeed, be its sole and only purpose. The average, smaller manufacturer eager so to proceed, but unable to decide on the methods to be used, can perhaps gain help from the following actual experience of a company which was successful in this way.

A certain factory, connected with the upholstery and bedding trades, and employing some 250 workers, was, like many others in the trade—or, in many other trades, for that matter—just able to manage to keep going, ever fearing a possible slump and never quite sure what the yearly balance-sheet would bring forth. This hand-to-mouth existence continued for many years until a change on the directorate occurred. The newcomers, holding more progressive ideas than their predecessors, began to seek for possible ways and means of building the company up into a sound and flourishing business. Their actions were first directed to the assessing of the all-round, market possibilities for their type of goods. All the information obtained in this way tended to show that an exceedingly good demand for the company's products would be forthcoming, provided these could be marketed at a much cheaper price, and, therefore, within the purchasing means of the average household. In view of this it was decided to set out with the definite object of obtaining this cheaper production. The trouble, however, was to know just where to commence. It was then that a very good decision was taken. This was to commence operations by appointing a methods man, and to leave the actual formulation of plans until this official had studied the position and offered his recommendations. In due course, therefore, a methods man was appointed, and set to work on the proposed scheme.

Six months later, after a period of intensive study of the company's products, the wherefores of each and every operation, and the gaining of familiarity with technicalities, control, administration, and general routine, a process, in fact, of learning the entire business, the methods man was ready with his plans. The basis of the report which followed was to the effect that the desired reduction in price was more than possible of achievement, as ways and means could, in fact, be found to produce the articles at a very small fraction of the existing cost, but that the actual process of achieving this would of necessity be one of accomplishment in stages over a period of

approximately two years rather than of quick and immediate fulfilment. The main reason advanced for this was that, although considerable reduction in manufacturing costs was possible immediately by means of an all-round improvement in existing methods, by far the largest proportion of the total reduction involved was dependent upon the existence of considerably greater production quantities than the company handled. The crux of the question, therefore, the report continued, was how best to obtain these larger production quantities. To accomplish this by means other than by true demand was unsound, and might possibly involve no mean financial loss over a period. The best solution it was suggested appeared to lie in creating this demand in a series of successive stages by means of periodic reduction in selling-prices, made possible by improvements effected from time to time. The improvement which could immediately be obtained would, it was pointed out, have the effect of making possible a decided reduction in selling-prices, which in turn should be responsible for a very definite increase in orders. Given this, further improvement could then be obtained, which would again allow another reduction in selling-prices, and consequent increase in the matter of demand. This process could then be repeated over and over again, until finally the factory had reached a stage of being firmly established on a mass-production basis, and engaged on turning out large production quantities at an exceedingly cheap price per unit.

The company decided to adopt the method man's recommendations and proceed accordingly. The results of the first revision of manufacturing methods was most satisfactory, and made possible a 20-per-cent reduction in selling-prices. Markets were not slow to take advantage of this, and, as a result, orders began to flow in at a far greater rate than ever before. Immediately this occurred stage two of the revision was put in operation, and a still further reduction in selling-price soon became possible. This process of lowering manufacturing costs continued steadily on with the result that a reduction in selling-prices occurred every three months. Sometimes the reduction was as much as 10 per cent, sometimes only 5 per cent or even $2\frac{1}{2}$ per cent, but whatever the amount, some reduction did occur each quarter for a period of approximately eighteen months. When this time arrived manufacturing methods in the factory had reached the stage of being in a decided semi-mass-production state, and only possible of further improvement by a last and final change-over to a full mass-production basis. Before making this last change the company reviewed its policy. The pros and cons of the position were fully considered. The company, it was admitted, was doing very well as it was, handling a large amount of business and making a fair profit. On the other hand, however, full-scale mass-production would bring immeasurably more business, and also a greater margin of profit per unit manufactured, because with selling-prices already at an extremely low level, the company need not pass on to the consumer the whole benefits of the change, but could make a substantial cut, and at the same time improve its own profit margin. The case for mass-production won. To-day the company is one of the largest known producers in the world of its type of

products, and also one of the best-paying businesses, in relation to its capital outlay, that could possibly be found

It is a recognized fact in the large engineering company that the worst production headaches come not from inability to produce the large component parts to time, but the small and often insignificant items such as pins and studs. Repeatedly it is found, for instance, that large parts such as crankshafts, gears, shafts, castings, etc., each probably involving a huge sequence of operations, often of a most intricate character, are produced well to time, only for it to be discovered that the entire production schedule is thrown completely out of gear for want of some small odd parts from the auto-shop. The reason most frequently advanced for this is that the large parts, being major items of the product, are obvious to all concerned as being essential to the building of the product, and consequently receive the fullest possible attention, while the small odd items, despite their equal essentiality to the product, are nevertheless repeatedly overlooked and forgotten.

It is in attempting to cope with problems of this nature that the average company goes astray. It does so by reason of the fact that managements seem unable to rid themselves of the belief that serious faults must necessarily involve the use of elaborate methods as a cure. Consequently, as so often happens, some costly method is introduced, only to find that it has failed in its purpose, having only touched the fringe of the matter, leaving the real source of trouble still untouched and lying hidden beneath the surface. To avoid misplaced action in this way, it is essential to have a correct diagnosis of faults. As this, however, requires a certain amount of specialized experience the uninitiated should make use of one golden rule—namely, “when in doubt try the simple methods first.” Action on these lines would, indeed, save many companies much trouble, anxiety, and expense. This certainly was the case in a large engineering company, employing many thousands of work-people, where the management for a long time experienced much anxiety in respect to the low output of its automatic machine-shop. The position at one time was so bad, as the result of this re-occurring want of a few simple auto parts each week, that the company’s entire future production programme was indeed at stake. Attempts to rectify the position had involved the introduction of many varied methods. Despite the fact that many of these managed to settle the matter on paper by producing schedules which showed how easy it was for the programme to be met, the shortages still continued to occur. Indeed, these actually grew in increasing volume as changes of method were applied in greater frequency. As additional plant was unobtainable at the time the company had, in fact, reached the end of its resources, and was vainly trying to sub-let much of the work, when a visitor to the plant gave the clue which was so badly needed. His advice, which was to the effect that the company had allocated far too many machines to each charge-hand and setter, was tried, and immediately proved to be the answer. Indeed, within a very short time the auto-shop, with additional charge-hands and setters sharing the responsibility, was actually in advance of production of the rest of the

factory, and able to maintain a good stock of all types of parts in the finished-part stores

The moral contained in this practical experience is of the utmost value to all types of manufacture. Only too often is false economy in the use of supervisors and staff the root trouble of many otherwise unexplainable failings. An extra £5, £6, or £7 per week on overheads can be a mere drop in the ocean compared with the increased efficiency which can accrue from lessening of over-burdensome responsibility.

The Direct Way

The direct way of aiding production is by arrangements closely connected with the actual manufacturing process itself. In an engineering machine-shop, for instance, the machine, its tooling, and how these are used, largely forms the scope of this activity. Success here is most important, because no system or method directed to aid and facilitate production can possibly make up for failings which occur at the actual machine or process, and which thereby cause manufacture to be incorrectly carried out. It is for this reason that operation planning is so very important. By thus specifying the correct way to do each job rule-of-thumb methods are avoided and the correct degree of speed, accuracy, and price is ensured. To accomplish this fully, however, needs the use of the technician, the planning specialist, who, being thoroughly conversant with the latest current practice, is the best able to determine correctly the type and sequence of operations to be used. Sheet-metal trades and certain of the heavy industries, who were probably the last to undertake preoperation planning to any appreciable extent, are, however, now finding it an excellent means of improving their manufacturing methods, and consequently reducing manufacturing costs. The need for operation planning is, however, by no means confined to the engineering trades. In fact, at the present day many factories in a variety of trades utterly divorced from engineering are now equal, if not greater, users of planning than many advanced engineering companies. The principle of operation planning cannot, in fact, be completely disregarded in any business, even where manufacture is solely represented by one or a small number of unvarying operations. To do so is to act contrary to all true progress, whereby any given method exists only until a better one can be found. With modern progress as it is, it is, indeed, a highly dangerous outlook to consider any one process of manufacture as being constant and unchangeable, as so many companies have already found to their cost. Industrial history is full of cases of this type, where companies have retained the same manufacturing methods year after year, only to find their goods suddenly unsaleable owing to the marketing of a similar type of article made under a completely new process.

The most common failing in regard to operation-planning activity lies not so much in its meagre application as in its mis-use. Planning staff should not, as at least one Continental company interpreted it, be used as glorified clerks, to write out piece-work price-tickets and works order-cards. Neither should they be considered as a form

of stock-chaser or additional assistants to those in charge of actual production. There is a specific and very definite task—namely, to determine at all times the best way in which a given piece of work can be produced under existing facilities. This naturally entails not only the original planning of a given manufacture, but its constant observance in order that improvements can be effected from time to time.

Although the principle of carrying out manufacturing in the best possible way will be readily accepted by any manufacturer, it may not, however, at the same time be fully appreciated just how far operation-planning is responsible for this, and how its operation makes itself felt in the realities of manufacturing costs. The latter especially, being the bread and butter of any business, is of particular importance to a manufacturer. To prove this point unlimited examples could be cited to show how the total cost of all manner of articles—of large, medium, and small size, ranging from the heaviest possible item of machinery down to the most tender and fragile piece of work—have been drastically reduced as the result of the introduction of operation-planning. In fact, so wide and varied is the range of these instances that it is, indeed, difficult to decide on which one to choose as an example. Perhaps, however, the position can best be summed up by giving a brief account of the experiences in this direction, of a mid-European company. This company manufactured a product of cabinet type which was in fairly good demand and sold at a figure of approximately £45. As far as its appearance was concerned it was a thoroughly workman-like article, showing little evidence of over-fanciful design or state of finish. Its design also appeared to be carried out on sound production lines, permitting of simplicity and cheapness in manufacture. In fact, in every possible way it was just an ordinary well-constructed article, the equivalent of many so offered on the open market. Operation-planning was introduced, and in less than twelve months its selling-price was reduced from one of £45 to £29. To accomplish this did not involve the aid of additional manufacturing quantities. Neither were major changes to design incurred. The only alteration made in the latter respect was to secure modifications and alterations to design of certain parts, in order to obtain greater ease in manufacture. Herein lay the chief cause of the previously high manufacturing cost. Although from outward appearance the product had originally seemed to be of good design from a manufacturing point of view, this had been proved to be far from the case in actual practice. The majority of parts, it was found, contained little awkward features which absolutely forbade ease and simplicity of manufacture. With these points righted, the rest of the improvement was forthcoming from the use of alternative materials, and the replacement of incorrect and obsolete manufacturing operations by the best-known methods of current practice.

Operation-planning is, of course, just as concerned with hand-operations as with machine-work. Innovations tried during war-time, in an attempt to overcome the all-round scarcity of labour, proved that with good planning even the most highly skilled of hand-operations hitherto considered as only possible of being carried out

by fully skilled craftsmen, could, in fact, be broken down into a series of simplified operations capable of being performed by even the most raw types of dilutee labour. Like similar action taken in regard to machine-work, these efforts were applied over an exceedingly wide range, and produced many notable examples of very fine achievement on a great diversity of classes of work. There is much to be learned from these cases of simplification, especially those of the type given in the following example.

A large engineering organization, commencing a huge war-time venture, like many others so placed, became immediately faced with the tremendous problem of how to overcome the apparent impossibility of obtaining even a nucleus of skilled labour for certain trades. Serious as this shortage was with regard to skilled machine-shop and fitting-shop workers, it was even more so on many subsidiary processes to the main production. The one department in this class which was causing this particular company the greatest anxiety was the coppersmiths' section. Here, not only was the shortage of skilled workers infinitely more acute than in the average section, but added to this the company knew very little about this highly specialized class of work. Seeking round for ideas and guidance as to how this position could best be overcome, the company encountered nothing but firm and definite advice that if skilled coppersmiths could not be obtained then the company could not possibly hope to undertake this work, and would have no alternative but to sub-let. Many of these sources of advice, companies with long experience of the class of work, made it quite clear that the use of trainees on this type of work would be a very risky business, while any contemplation of the use of female labour was, of course, utterly out of the question. Unable to discover anything like the required extent of capacity available among outside sources, the company decided to try to handle the proposition as they would any ordinary, every-day, engineering job, and accordingly set their own planning-staff to work. The result was that in due course the coppersmiths' department became the outstanding achievement of anything of its type in the country, producing by fully tooled, simplified processes large quantities of accurate parts, with a labour force which was 97 per cent female workers.

Although all types of production can be aided in no uncertain manner as the result of planning the job correctly, by using the right machine with the right tools at the right time, and by controlling the flow of material in suitable relation thereto, the full value of these total efforts will only be forthcoming provided correct maintenance is given to machines and equipment. Only too often is this faulty and the direct cause of major breakdowns and consequent serious hold-ups to production. The large, mass-production companies are fully aware of this when they endue their maintenance staffs with a spirit of "keep the machine running at all costs." These companies also offer a decided lead to others in the use of labour for maintenance purposes. Experience has taught them that the exacting demands placed on machinery and equipment by modern production calls not for the use of the 'handy-man,' but for highly skilled tradesmen-specialists in each of the various sections comprising plant-maintenance work.

CHAPTER VIII

THE MANAGERIAL SPHERE

MUCH has been said and written in recent times about inefficient management. For many years a highly controversial subject, it rose to unusual prominence during the war years, when, with production and still greater production the great outstanding national need of the moment, charges of inefficiency in the production of war supplies naturally became a matter of great public interest and concern. As could be expected under such conditions the case for or against was often clouded by grossly irrelevant details and accounts of supposed happenings in practice. The person most confused by all this was probably the average manufacturer in a small or medium way of business, who, moving more or less in a very limited circle, really did not know what to believe. On the one hand he heard rumours of large concerns being taken over by the Government on account of inefficiency, while on the other he was continually brought face to face with many and varied charges of gross absenteeism on the part of the workers. Under such circumstances, and with a case of managements blaming workers, and workers blaming managements, the absence of true facts made it impossible for an independent observer in any way to form a true picture of the correct position. What the true state of affairs was, and who was the most to blame, is past history and matters not. What does matter, though, and is, in fact, of vital importance to the general well-being of British industry in early post-war development is the question of whether both sides have at least profited by this experience, and, by each recognizing his own shortcomings in times of need, are prepared, and equipped to take steps to right positions which would undoubtedly prove of far more serious consequence in times of lesser demand. Had faults on the managerial side been few and confined to, say, a small number of concerns the matter could have well been completely disregarded. Unfortunately, however, such was not the case. Even completely ignoring the wild and often apprehensive stories which circulated at this time, there still remained a great amount of truth in the substance of the attacks made on managerial efficiency. Many were the cases, in fact, where production did undoubtedly suffer as a result of inefficiency in management. The existence of a state of affairs of this kind could not be explained away as the result of a dearth of first-class executives owing to the coming into being of so many extra plants, or of weakened staffs due to transference to 'shadow' enterprises and the like, because in the main the inefficiency was obviously one of long-existent fault—failings which had been present under pre-war conditions and which had only been accentuated by the stress of the times.

Despite the experiences of war-time production, there are many even to-day who firmly consider that any charge of inefficiency against management must necessarily be pure exaggeration. The worst offender in this direction is usually the managerial executive of the large organization. To some extent such a view-point is understandable in his case. Having as a rule spent a lifetime in the sheltered sphere of the great enterprise, he consequently knows little of industry as a whole and the thousand-and-one different problems which confront managements in that vast range of medium-sized and small businesses, which comprise by far the largest portion of the industry of any nation. The fault is not his, it is the result of privilege. Part of a large organization, and backed by all the power and resources which such an enterprise can wield, he is apt to forget that his conditions are the exception not the rule, and that his equivalent elsewhere shares no such favourable advantages. Even so the wise man in the large organization is one who not only is aware that all is not well in the managerial sphere at large, but even acknowledges it within his own organization. Such a view-point is, in fact, essential to the further progress of some plants, because, while certain large organizations are approaching the ideal, others, indeed, are the reverse, and are far from well organized. The fact that certain of the latter show immense sums as annual profit misleads many as to the true state of affairs within these concerns. They themselves, the industry, the nation, and, in fact, the entire British public would benefit much more were the advantages of these companies, and their many excellent attributes, exploited more fully by greater efficiency in the managerial role. Only too often is it a case of the work of an admirable directorate and the efforts and ability of the best technicians and craftsmen in the world, being in no small measure offset by rank inefficient management. The wealth and standing of these organizations often proves its own handicap. Many a manager of this type of plant, being free from the policy questions which the management in a lesser-sized business is often forced to undertake, and surrounded by a team of specialists, each largely of executive rank and calibre and being able to acquire the latest and best plant as and when required regardless of expense, uses not his unique advantages to study and apply management as it should be applied, but simply adopts a most passive role, content to drift and share in the measure of success which the others are bound to make. This criticism, if it can be classified as such, is necessary for two reasons, firstly to cure a widely held, incorrect belief that inefficiency in management is a special peculiarity of the medium-sized or small business, and secondly to hammer home the fact that only by wise recognition that no one has yet reached a state of perfection, and that faults exist in all types and forms of business, can British industry hope to profit from past mistakes, and thereby secure and hold for all time the place which is rightly hers.

It is in the belief that a general airing of the managerial problem may offer some thoughts on which improvement may be built that the following sections of this chapter are devoted to a study of the good and bad features of managements' present-day application. Reference to poor conditions, it should be stressed, deals not with

exceptional circumstances peculiar to any one special size or type of concern, but covers points generally indicative of conditions found in many sections of industry. Cases given in this respect are, in fact, practical examples which are known to be common to a goodly number of companies.

Management Failings

The inefficiency which exists in management is largely a question of the failings of the individual. In the one branch of business organization where the need for personal qualities is so outstandingly necessary are qualifications often at their lowest. As a general rule, where a management executive has requisite experience and knowledge he is usually not of the right type, and if suitable in the latter respect he usually fails to function correctly owing to a totally inadequate grasp of business affairs. Seldom, indeed, is he pre-eminently an organizer. The fault is entirely one of wrong selection, which allows totally unsuitable people to be chosen or thrust into such highly important posts. Over and over again are managerial posts given to people with negligible training and experience, without organizing powers, and often without breadth of vision or even good mental ability. They are mainly friends, relatives, or school chums, and the main evil exists not in that they have to be carried, but in the damage which arises from their presence. The practice would cease immediately had directors of businesses the slightest conception of the extent of the ill-effects which such appointments cause. Repercussions come mainly from disappointed and disgusted staff. For safety's sake this antagonism is often kept hidden under the surface, where it festers and grows until it becomes a highly cankerous danger to the general well-being of any business. It is foolish to scoff at this antagonism, to call it peevishness, and infer that 'they' will get used to it in time. The point is they never do. It is always a source of much trouble and great loss not because of the discontent of other members who would have wished the post, but because it goes much deeper than this, and cuts across principles in that it offends any worth-while worker, from the highest to the lowest, who, wherever he may be found, at heart appreciates working for someone who 'knows' his job, even although 'life' in the process may be a considerably harder lot.

The position was aptly summed up by a leading industrialist who likened the filling of managerial posts by influence as akin to his being placed in charge of a large law practice. With average luck and good assistants the business would go on, but it would never improve. Another well-known figure in the industrial world tersely remarked, "If you must find a man a job you must, but why give him the one post where he can control your bank balance?"

Probably the worst type of management executive is the one who simply 'sits on the fence'. This type is often excessively flattered by being referred to as the "creator of balance". In point of fact, they create nothing except entire lack of decision. The reaction to this varies according to the type of staff concerned. In some cases it results

in important matters being constantly held up, awaiting the manager's decision. In others, especially where the staff is of the better type, repeated failure to secure decisions results in the managerial chair being completely side-stepped. The latter is by far the worse evil of the two. Departmental heads, recognizing the complete futility of attempting to secure practically any decision from the manager, act independently and take matters into their own hands. Consequently there is often not only utter confusion but also the breeding of complete disunity between the various section heads. Experience has proved that the latter evil follows as surely as night follows the day. Where a staff lacks the controlling medium of an arbitrator on matters of dispute, or fails to secure decision from the one person empowered to give it, co-operation gives way to individualism of the worst possible type. Under these circumstances the work of each member of the staff begins to suffer as each concentrates on the prime task of jockeying for personal position and advancement. Efficiency also suffers to the extent that actions at all times are guided by the chief consideration that the doer shall not be tripped up. Of this type of management one is bound to say, "Thank God that some have efficient secretaries."

By no means uncommon, yet fortunately gradually becoming extinct, is the managerial executive who is always bullying and cursing. Never a good word to say, and certainly never dreaming of uttering a word of praise or encouragement, he may for a time succeed in frightening timid members of the staff—but not for long. Thereafter he becomes 'accepted,' either as a stock joke or alternatively as a complete non-entity. The ridiculousness of his constant ranting and raving is that when the time comes that he really has something to shout about he cannot succeed in driving it home because workers have got so used to it that they naturally consider that he's 'at it again.' Wise companies have realized that this loud-noise business is not 'drive,' but simply a thoroughly disturbing influence which they can best do without. It took a large engineering company—one which is now famed for its efficiency—many years to realize that the cause of many of its apparently inexplicable inefficiencies was purely and simply that it had men of this type occupying leading managerial roles. A change was made, and the failings began to disappear. To-day the company pulls that little extra as a result of wise management which praises as well as scolds, and which consequently has produced so great an atmosphere of faith in the management's sense of fairness that even the slightest mark of its displeasure is sufficient to get people to jump about, eager to right matters which unquestionably must be important.

A type of management which it is felt needs no comment is the kind which existed in pre-war days in a certain cotton-mill. The business which was for ever in trouble, of first one type and then another, was handled entirely by uncle and nephew. The uncle, who occupied the position of managing director, was an infirm old man of eighty-three, while the nephew, who was the mill manager, was a boy of twenty, just up from college.

If wise management be important anywhere it certainly is so in the small business. The wrong action here, whether it be on the one hand slowness to move, or, at the other extreme, impetuosity or over-elaborateness, can have equally damaging effects. The kind of habit, for instance, such as the perpetual knocking down of walls and building them up again in some other position, which is the playful pursuit of the managements of some large companies, can be a most damaging practice if translated in principle to the small company, where any form of expense, be it capital expenditure or indirect charge, constitutes a grave burden on the limited financial resources or turnover available. Obvious as this would seem, it is nevertheless surprising how many small companies incur extremely swollen overheads as a result of management failings in this way. Whatever the actual form which wastage in any one company may take—although probably in no way connected with structural alterations or even the far more common practice of perpetually seeking alterations by way of a redistribution of various types of internal fittings, both these points being, of course, really only symbolical—it is part of a general all-round tendency of managements to dwell on many extraneous matters at the expense of the prime task of any manufacturing business—namely, to produce quality at a price. The answer to this, of course, lies in such managements' taking up a study of the principles of cost accounting. This is far from being without precedent. Many a company, in fact, owes much of its present-day success, through having in the past had sufficient foresight to prevail upon leading staff-members to improve obvious failings and weaknesses by taking evening courses in specialized subjects, or a complete course on Works and Factory Management. Where many educationalists go astray is in viewing the need for training on management as applicable only to the possible management executives of the future, thereby ignoring the man at present doing the job, and who is likely to remain at the helm for many years to come.

Adverse Effects on a Business

It is not generally appreciated just how serious the effects of poor management can be on the well-being and prosperity of a business. Management does not, as some appear to think, consist merely of tying together a number of loose ends, neither does it amount to the sum-total of being the 'boss element' which 'sees to it' that people do sufficient work. Management, to be correct, is the medium whereby the policy of a company, as emanating from the directorate, is expounded and interpreted to workers and staff in the form of set lines of organization, and by means of a definite lead, which is thereafter pursued to completion by widely judicious handling at all stages. Where this is carried out results speak for themselves. The contrasting for instance, of any three companies of like type and size will quickly show which has the best management. A really astonishing picture would be unfolded if ever the Government revealed facts and figures about comparable plants in Great Britain during war-time. On the aircraft side especially would it be seen that certain companies blessed

with good management succeeded in producing infinitely more of the same article at much less cost per piece than other companies similarly engaged, but who held the added advantage of considerably larger plant capacity and a far greater labour force.

Bad management, of course, reacts on the efficiency of companies in many different ways. In many large plants it shows itself unmistakably on actual production, where, despite the large-scale manufacture involved, and the knowledge of competitors' methods, work continues to be carried out to a large extent in 'tool-room' fashion. This kind of fault, which does occur in quite a number of large concerns, is entirely due to the management's lack of requisite knowledge of modern production methods. Given this, they could not possibly rest until action had been taken to put right conditions which permit competitors to manufacture identical parts to their own in a very small fraction of the time. The need to remedy these conditions is not only advisable, but is, in fact, fast becoming essential. It will continue to become more important as time goes on, because in the market of the future it will not be possible for outstanding ability in design and excellent quality to completely override the question of price. The really successful company will have to produce corresponding efficiency in each. Matters are slowly drifting that way, success in designing is no longer the outstanding attribute of the few, but is fast becoming within the grasp of the many. From a national point of view it would, indeed, be a blessing if certain large companies who are pre-eminent designers would confine their activities to this direction, leaving actual production to be carried out by those best qualified to undertake it. The suggestion is not impracticable, in fact, it has already been successfully tried out in some countries, where combines and amalgamations, instead of taking the line of joining together a group of similarly placed companies, has been specifically directed to secure the amalgamation of the essentially designing specialist with the company who is first and foremost a producer.

One outstanding reaction of poor management is the ill-equipped shop. It is perhaps its most common form, because up and down the country can be found operators of plants of all kinds who labour under the almost impossible task of attempting to produce quality and quantity from completely obsolete machinery and equipment. Only too often are production engineers, for instance, expected to work miracles in some old-fashioned machine-shop. That they manage to keep such places going at all speaks volumes for their ability and general, all-round ingenuity. No degree of ingenuity, however, can overcome the type of thing recently found in a Black Country firm, where, owing to the obsolescence and generally shocking state of the plant, material had to be fed five times through the same process in order to arrive at the stage which other companies produce in one operation. The former is by no means a freak case but, on the contrary, is, indeed, only too typical of many manufacturing plants where inefficient management allows the perpetuation of obsolete equipment. More often than not conditions of this type exist as the result of a totally false impression of the scope of a worthwhile economy. Naturally all managements have need to take

the utmost steps to safeguard against unnecessary wastage and extravagance, but to apply this to the extent of crippling the efficiency of the very thing for which a business stands is not economy but the very height of folly

The following case, typical of conditions in a large number of companies, may provide the answer to a question which at some time or other may have puzzled many concerns—namely, why certain companies never deal with them. The directors of an engineering company, employing some three hundred workers on the production of a light-type heating medium, were greatly concerned at the fact that the company's clientèle was slowly dwindling, and that for some unknown reason it seemed impossible to widen the company's scope and attract new customers. A study of several years' past workings had shown that year after year the company had just managed to keep going because of the retention of the bulk of its old customers, but that while first one and then another of these had dropped out over the years, for reasons entirely beyond the company's power to control, no replacement had been forthcoming from new and additional sources. Indeed, the records proved that the gaining of an entirely new customer was in the nature of an exceptional event worthy of celebration. What made the matter worse from the company's point of view was the fact that the total range of customers on the company's books represented a field which was merely the fringe of the national requirements for their type of article, and that the largest and, in fact, main market lay in sources still completely untapped by the company. With this need to break into new ground becoming essential not only to the company's future prosperity, but, indeed, to its continued existence, considerable thought had been given to possible ways and means of achieving the desired end. In this connexion the company had endeavoured to put its own house in order to the extent of concentrating on the factors of quality and price. Although it proved comparatively successful in this, and quality and price became approximately equal to that of the average competitor, the desired market still continued to elude the company.

The mystery would probably have remained unravelled had not the managing director of the company become associated in private life with the purchasing manager of one of the largest users of his company's type of equipment—a company from which orders had long been vainly sought. Faced with the position, the purchasing manager had first tried evasion, but under persistent persuasion he at last gave the reason why his company did not place orders with his questioner's company. This, it transpired, was due not only to the small company's complete lack of any sense of co-operation, but in addition to its complete disregard for even the very ethics of ordinary business. The process of obtaining supplies, it was pointed out, was not concluded by the mere fact of placing an order, but more often than not involved no mean amount of contact with the supplier from the time the order was placed until actual delivery had been obtained. It was in this interim that his friend's company was so sadly amiss. Contact with the company not only failed to break down serious inattention, but brought forth gross incivility and, in fact, downright rudeness. Inquiries made in the past

with a view to the placing of orders had received such shocking treatment that his company had no intention of repeating the experience, and certainly not proceeding further while this state of affairs continued. The purchasing manager then went on to explain that although his company's experience had been bad, the experience of others had been far worse. Many of these, who had actually gone as far as placing orders, had become so disgusted at the treatment given that they had either cancelled the orders, or at least sworn never to repeat. This had been the experience of so many, and had become so much common knowledge that the company undoubtedly held an unenviable reputation in trade circles. Asked why it was that complaint had not been made to the company officially, the purchasing manager explained that this certainly would have occurred had inattention and rudeness been forthcoming from one individual only. This, however, was not the case. His buyer and, in fact, buyers from several companies had made it clear that the attitude complained of appeared to apply to the entire staff. It was said that letters addressed to the company officially, or marked for the attention of any one of a number of leading members of the staff, failed to produce attention, while a 'phone-call was sufficient to make the caller put down the receiver in disgust.

Determined to investigate the position fully, and to clear up matters by first arriving at a definite understanding of just what was involved in the complaints of inattention and excessive rudeness, the managing director decided to embark upon a thoroughly practical test. To that end he arranged for a great personal friend of his, who was a manufacturer of a large enterprise, to order some equipment from the company in an ordinary way of business, and to keep him fully posted of the course of events. The results more than bore out all that had been said about the company. Making first contact by 'phone, the friend found it exceedingly difficult to raise even the slightest interest in his requirements. On inquiring about the prospects of obtaining a certain type of unit, he was straightaway told point-blank that he needed no such thing, and that what he required was so and so. This attitude was persisted in until, after some twenty minutes or so on the 'phone, and talks with first one person and then another he threatened to report the matter and to obtain his needs from some other supplier who would have no difficulty in readily supplying a standard article. This did the trick—grudgingly came the offer to supply at a certain stated figure. Inquiring to the best delivery possible, he was informed that this would have to be looked into and, therefore, the company would write him in due course. Ten days went by and no advice of delivery had been received. Telephoning again, he was rudely informed that no delivery could possibly be quoted until he had made known his requirements in writing. This done, and a further seven days passing without receipt of advice, the manufacturer again 'phoned the company, whereupon, after a further series of talk with innumerable people, he was informed that delivery would be possible in a few months' time. As this brought forth sharp protests against the absurdity of so long a period for the supply of a standard article, the delivery was reduced in a series of

stages to a final figure of fourteen days. Put in writing, the order was duly accepted on these terms. Three days prior to this quoted delivery date the manufacturer 'phoned to inquire if the job was proceeding to schedule and would be dispatched at the stated time. To his amazement and disgust he was flatly told that the job had not even been commenced, and could not possibly be until they had been advised of the type of electric current on which it was intended to operate the unit. It was at this stage that the would-be purchaser washed his hands of the affair, and concluded matters by passing his friend a true record of all that had transpired up to that point.

In the investigation which followed it was proved that the fault was entirely the management's, which was completely and utterly oblivious to what was going on around it. This was also true in many other ways, as altogether the management took but a passing interest in anything. Unlike an efficient management, they neither knew what was happening from day to day, nor took steps to find out. A change was made, and live and efficient management was introduced. Results consequent upon this speak for themselves, as to-day this company is a flourishing business holding unusual prestige for its civility and attention and all-round, keen, prompt and efficient service.

It is felt that the foregoing example, which is an almost verbatim account of an actual experience, will have served its purpose if it succeeds in drawing attention to a little-known, serious consequence of inefficient management which is the hidden cause of many a company's apparent inability to prosper. Although the actual facts as given will naturally not be the same in all cases, there is no doubt whatsoever that some measure of this rank, bad conduct and complete inattention to affairs is active behind the scenes in many businesses where it is least expected. The manufacturer, therefore, who is concerned at his company's inability to secure a fair share of orders, should not confine all his activities to sales, quality, and costs, but should also probe behind the scenes to see if all is well with the reception end.

Aspects of Good Management

If good management stands for anything it first of all stands for system, order and method, within the four walls of the manager's office, and not, as so often is the case, important and urgent papers lying around for days on end, while newspapers and trade journals are viewed at length, or minor and comparatively non-important matters are pursued to the utmost conclusion. As the average management is confronted with a great mass of detail, it is most necessary that the utmost steps be taken to sift the wheat from the chaff, so that routine and minor matters can be delegated to junior staff, leaving only matters of consequence to occupy executives' valuable time. Even so the latter can only be efficiently handled where system and method prevails. The methods which a general manager of a large efficient organization employs in this

respect are not only of interest, but also of sound educational value. On this executive's desk at any hour of the day can always be found a special pad, which contains a complete list of all the matters awaiting his attention and the sequence in which these are to be handled. Each night before leaving the office he reviews his entire outstanding programme, and carefully maps out the following day's work, which is recorded on the pad in the order of preference necessitated by urgency. The programme so mapped out is derived from correspondence awaiting attention, including both letters and reports, all matters which have been raised verbally, and issues and routine matters which it is considered need investigating. Whenever a thought occurs to him, connected with either a point which needs looking into or some improvement which should be sought, down it goes on the pad ready for listing into a specific day's work. First thing each morning correspondence is reviewed, and the programme of the day's work is amended as necessary. This done, work is commenced by dealing with letters and matters according to the predetermined sequence shown on the pad. As each letter or note is dictated, the corresponding item on the pad is ticked off and later is completely crossed out as the finished letter or note is duly signed. The same thing happens with regard to matters which do not involve correspondence. That the worker to this plan seldom ever achieves the full day's programme which he sets himself is beside the point. What does really matter is the fact that, through so systemizing work, he has never been known to fail to institute timely investigation of routine or general business matters. In addition to this the method has earned for him an undoubted reputation as being the fastest and greatest handler of correspondence and general matters ever known in business circles.

Probably the primary secret of any outstandingly successful management lies in the fact that it is able so to function because it really does know what is going on around it day by day. This knowledge is not gained by chance, but is purposely sought. It is the result, in fact, of an attitude which is the direct opposite of that held by inefficient managements, who excuse lack of knowledge on practically any subject on the grounds that running a modern business involves such a tremendous amount of detail that it is beyond human powers for any small group of people, and certainly an individual, to be cognizant of more than a very small amount. Herein lies the crux of the trouble. It is not the purpose of management to concern itself with detail—that is the task of others. What management has to do is to make sure that this detail is being attended to in bulk, and that the over-all results obtainable from it are satisfactory. To do this necessitates a picture in total, and not a mass of irrelevant and often highly confusing detail. There are many different ways of obtaining this picture. Probably the best method is that used by many highly efficient organizations, who use a special chart-room for the purpose. In this room, which is kept solely for managerial use, are kept a number of charts which show the latest position on a wide variety of subjects. In fact, every important activity in the business is represented by a chart which pictures the progress made over a period, and the latest position at any given date. The

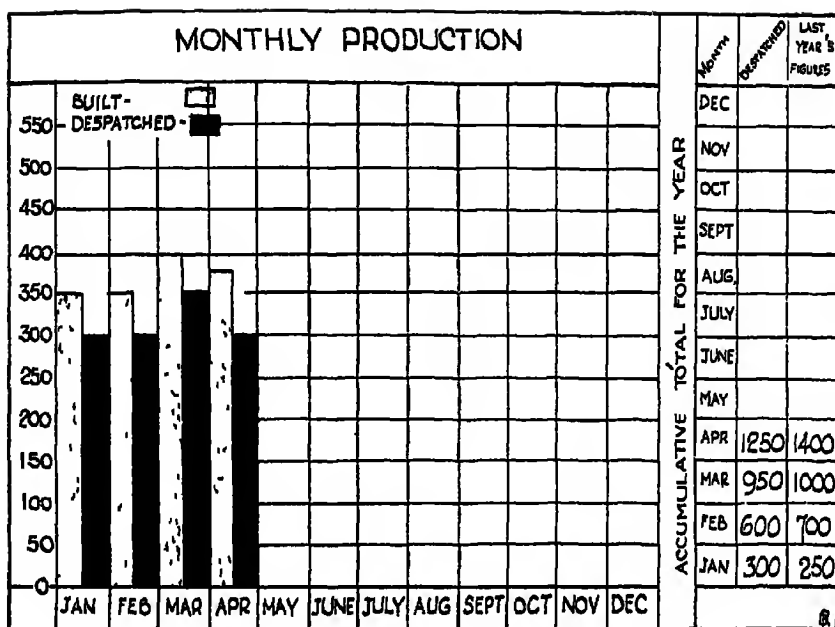


FIG 15 A USEFUL TYPE OF OUTPUT CHART

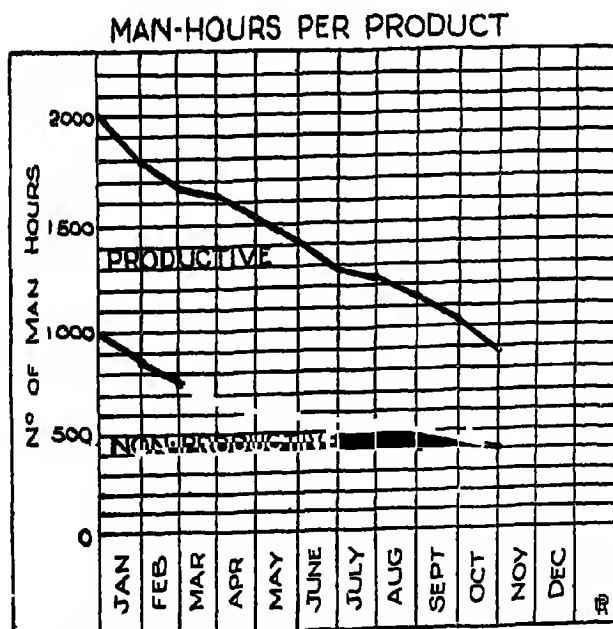


FIG 16 A VERY USEFUL MANAGEMENT CHART FOR KEEPING A CHECK ON MANUFACTURING COSTS AND THE PROPORTION OF INDIRECT TO DIRECT LABOUR

management, therefore, without need to consider a mass of detail, is enabled to note on sight the general position in respect to terms of output and cost, and other important factors, as well as the amount of work accomplished by any works or office section during a given period. The latter is most important, because it enables the management to keep a grip on things, and, in addition to knowing what is going on, to have the necessary information to enable remedial action to be taken when and where required. The machine-tool position in an expanding enterprise, for instance, can be immediately checked by a glance at the respective chart, which, by showing the gross number of machines ordered week by week, and the corresponding numbers received in the plant, immediately shows if the planning department is specifying machines at the desired rate, or if the machine-tool purchasing section is placing orders speedily enough, or is failing to obtain delivery in accordance with schedule. The charts kept on labour and factory-working hours are important. These make obvious such matters as absenteeism and sickness, as well as enabling a definite check to be kept on the extent of the total pay-roll, the proportion of indirect labour to direct labour, and the amount of over-time worked per department. The amount and types of stock carried, man-hours per unit produced, the quantity of gas, coal, and electricity used, transport costs per unit dispatched—these are but a few of the great diversity of highly important matters which are charted, and which co-jointly furnish managements with a truly comprehensive picture, enabling them to well and truly hold the reins.

Management to be effective, however, cannot rest with merely making sure that workers and staff are fully employed. The latter in itself, although most necessary, is far from sufficient. To be conclusive it must be sure that the work is really profitable, that it is directed along the right and best lines, and that each section of the business has a very definite goal in view. To do this involves the application of the finer points of organization, as well as the use of drive on the management's part. To consider the latter first, it should be emphasized that drive is not senseless, loud-noise stuff, but the management's specific lead to make possible the attainment of a fully predetermined plan. This is best accomplished by the issuing of 'targets' which in schedule form, on a weekly, monthly, or even longer-period basis, set forth particulars on the aim in view. Rightly handled, these targets become the veritable Bible of all concerned, and as such are an incentive. For the plan to work successfully, however, it is essential that the target figure be wisely set, being neither impossible of achievement nor too easily attained.

That some companies who do work the target principle still fail to achieve the best results is due to the very limited way in which they apply it. Their fault lies in the fact that drive in their case is entirely restricted to the sole task of urging actual production, and ignores the many indirect activities which have such an important bearing on the degree of success obtainable in this sphere. The efficient company, realizing the importance of these indirect activities connected with production, and

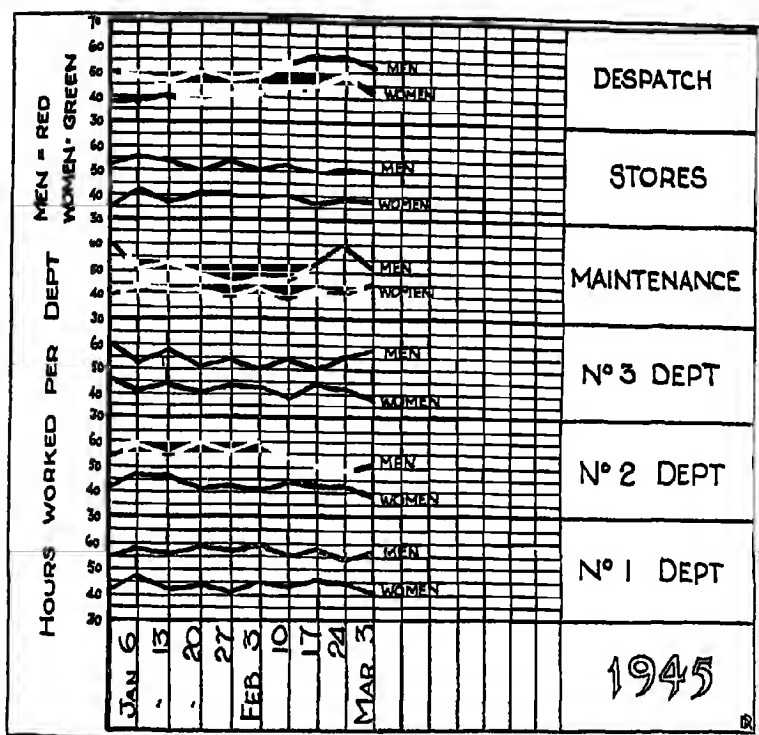


FIG 17 A USEFUL MEANS OF KEEPING A CHECK ON THE AVERAGE MAN-HOURS WORKED PER WEEK BY EACH CLASS OF LABOUR, AND ESPECIALLY IN REGARD TO SUCH FACTORS AS 'OVERTIME'

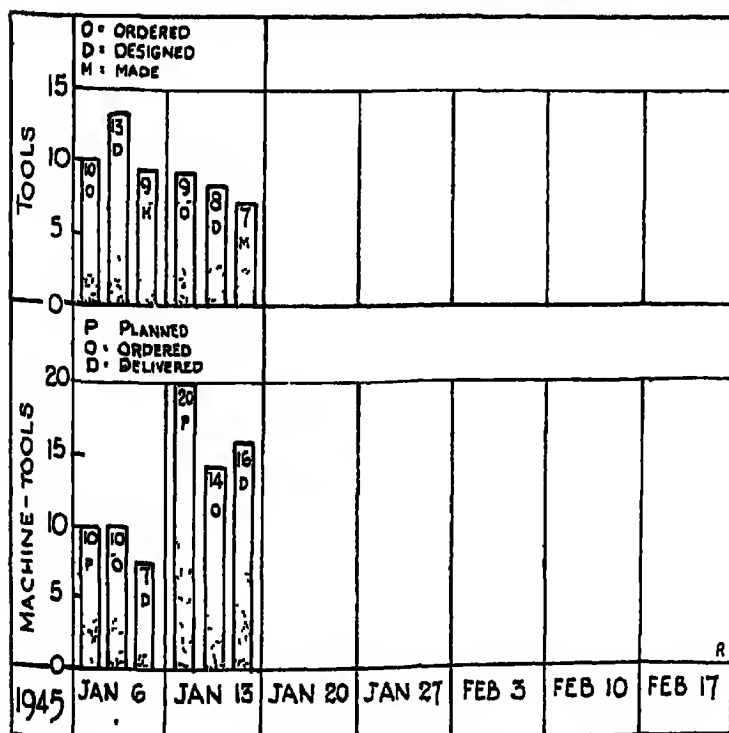


FIG 18 A USEFUL MACHINE-TOOL AND TOOLS-POSITION CHART

how success or failure in any one can make or mar the whole production programme, wisely caters for these in the same way as the main issue of production, and sets targets for all activities which have a bearing on the fulfilment or otherwise of the general plan. A target set, for instance, to achieve *X* production per month at a date commencing six months ahead would involve the setting of a number of lesser targets, one to each section or department involved, each of which would state the very latest date by which the respective activity must be completed. The type of activity which would form the subject of these subsidiary targets would be such as the provisioning of equipment to a specified date, the purchasing or manufacture of the necessary tools, quantities of various types of material at varying dates, and the supply, or making available, of sufficient labour of the right type at the right moment. Varying according to the nature of the business or the scale of the project, it may also include many lesser, but none the less important, activities, such as the furnishing of necessary transport facilities, or questions of structural alterations or additions, etc. That the efficient company is able to undertake huge conversion schemes with amazing precision, to build up from nothing in an exceedingly short space of time, or produce a change of 'model' in record speed, is due entirely to wise management, which follows the practice of first creating a 'master plan' and then subdividing this into a number of set targets in chronological order for all departments to aim to achieve.

A source of much concern to the average management is the old debatable question of whether or not to use committees. By this is not meant the war-time innovation of joint meetings of workers and managements, but the peace-time habit followed by many companies in delegating small groups of staff-members into committees for various purposes. Also included in this category is the practice of holding a weekly staff-meeting, which usually, under the chairmanship of the managing director, is devoted to discussion of a wide range of matters connected with production. Judging the position from the widest possible angle, and from known facts of committee practice in companies of all types and sizes, it is evident that the use of committees is much over-done, and that, with the exception of their use in certain restricted spheres, the practice as a whole is one not to be endorsed. Contrary to a belief held in many quarters that by this means a most useful purpose is served, the true facts are that the distinct reverse is more often the case. Indeed, the practice in its most common form—namely, in regard to ordinary production matters—achieves nothing but a considerable waste of staff-members' valuable time, not to mention the effort and cost of compiling and typing reams of endless minutes. The greatest advocates of this method are those managers and managing directors who know of no better method of ascertaining what is going on around them than to institute a weekly meeting to talk things over with the staff. Their views as to the value of the system would undoubtedly undergo a marked change were they ever fortunate enough to overhear the conversation of foremen, superintendents, etc., as they leave meetings of this type. The real answer to the case for the use of committees on production matters

can be summed up in the fact that it is undoubtedly the companies which have the poorest production results which make the most use of this method. What to produce in a given time is not a question for a get-together talk, which usually produces heaps of reasons why most things cannot be done, but is the subject for sound organization around a definitely known capacity.

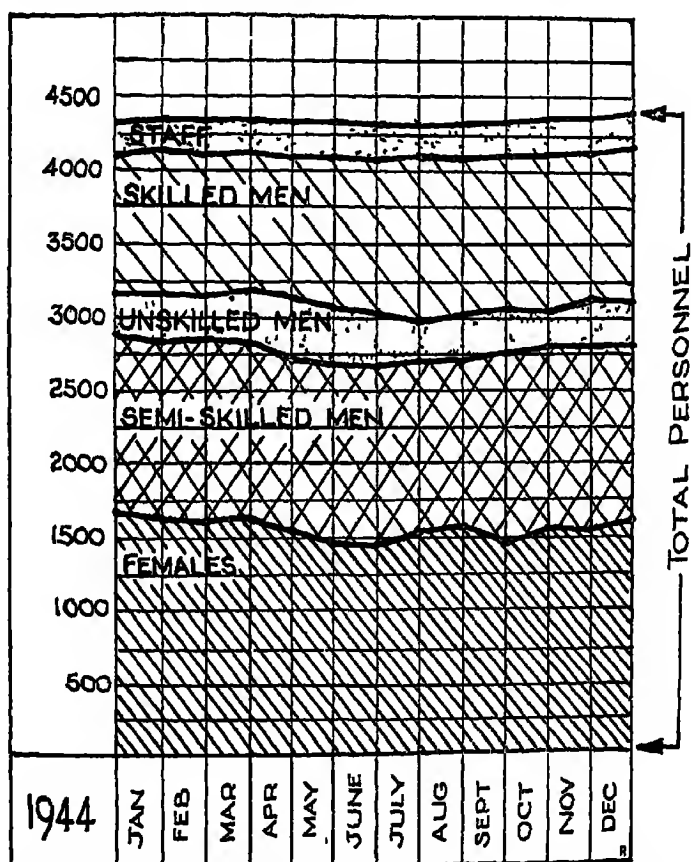


FIG 19 A BREAK-DOWN LABOUR CHART—SHOWING THE COMPOSITION OF THE TOTAL LABOUR FORCE, THE TYPES OF LABOUR AND THE NUMBERS EMPLOYED OF EACH, AND THE PROPORTION OF NON-PRODUCTIVE TO PRODUCTIVE WORKERS

While the practice of instituting weekly or periodic meetings on actual production is, therefore, one to be discouraged—whether or not the meeting be called a committee, a staff-meeting, or conference—there are, however, other avenues in factory organization in which the principle can be applied with very good effect. It is here that many large companies which hold a positive dislike and distrust of the use of committees lose much by the too rigid application of this objection. Rightly opposed to the general principle of setting up committees to discuss and debate how this or that matter

should be handled—which in itself is an admittance of lack of knowledge and poor organization on the part of the management—these large companies, nevertheless, allow their feelings to override their judgment to the extent that they swerve to the opposite extreme and frown upon the holding of any kind of meeting. In this they are at fault. Many would gain distinct advantage, for instance, from the periodical meeting of a small body to deal with matters connected with inspection and technical research. Only too often can failure from a product's performance point of view be attributed to lack of cohesion between the quality engineer, the chief inspector, the head of technical research, and the methods man, which results in each plodding an independent, narrow furrow in complete disregard of the views and actions of the others. The forming of these individuals into a committee charged to meet periodically to discuss the latest technical developments and maintenance of quality standards would produce results by minimizing the tendency of each to set themselves up as independent 'big shots,' with the attendant serious consequences of such a foolhardy practice.

One way in which the large business suffers in comparison with its smaller counterpart is that, owing to its size and the distant relationship which occurs between master and man, it tends to lose that invaluable factor of 'loyalty of workers,' which plays such an important part in the life of the smaller business. This is a matter in no way to be despised, and it behoves all large organizations to take steps to retain the value of the personal touch. To accomplish this, of course, involves much more than a management's adopting a policy of being approachable at all times. To make the proposition really worth-while requires no small amount of understanding and sustained effort on the part of those on whom the task falls. Its best application is not by way of costly welfare and sports schemes, but by the management's rediscovering that its workers are not so many cogs in a machine, but human beings, each with his own pet worries and troubles, to whom a timely word and the showing of a little sympathetic understanding produces a reaction far beyond the power and scope which organization can devise.

CHAPTER IX

THE PERSONNEL FACTOR

QUITE recently a manufacturer in a fair way of business had an opportunity of viewing an advance copy of a "Paper on Organization" due to be given at several branches of a certain professional institute. Scanning through the paper in the presence of the author, he read out the various headings offering fairly complimentary comments on each until he came to one entitled "The Personnel Factor." Here his remarks were terse and to the point: "'Personnel factor' Well—no, I wouldn't be interested in that." Pressed for an explanation, he admitted that he found it hard to stir up interest in such a prosaic matter, especially seeing that organization as a subject held many far more absorbing topics. Here indeed, was the answer to a question which had long puzzled the author of the paper and in fact, many others—namely, why it was that this particular manufacturer's works, although organized soundly in many directions, seemed to be never free from labour troubles and general discontent, which was for ever on the verge of fomenting either a strike or a lock-out. This failing is not exceptional, but is, indeed, true of many businesses. Probably the cause lies to a great extent in the fact that there are too many writings on the subject by people, completely ill-versed and unqualified in labour management and control, who have tried to elevate it to a kind of mystic science, more in keeping with the work and scope of the psychiatrist than the sound common sense required by the practical leader of men. Labour management is not, and never will be, as some would have us believe, a function designed primarily to deal with the neurotic and mentally disturbed, and which, by psychological treatment, aims to fit them into the general scheme of things. The works, the factory, and the office are not a mental home. True, psychology enters greatly into the picture—and woe betide any company which ignores it—but it stands to ensure wise handling and the best use of the average worker, not the freak exception.

The wise company uses moderation and a sense of proportion in its dealings with employees. It is so very easy to go to the opposite extreme. Many American companies, for instance, found this out for themselves when a craze for psychology swept their country a few years ago. To-day industry is still greatly divided on the question. First there is the type of company which practises psychology to excess, secondly the moderate and wiser user, and lastly the type of company which positively refuses to recognize any value in it. The latter is usually of the type which is still managed by the autocrat of the old school, who makes it quite clear that he has no time whatsoever for modern theories. Often the result is disastrous, and permits of almost unbelievable

happenings It is not many years ago, for instance, that an amazing cycle of events arose out of the labour dealings of a person of this type The works concerned was an old-fashioned one, with dirty floors, leaky roofs and walls, thoroughly ill-conditioned and ill kept, and dreadfully cold in winter It was during a particularly cold spell that the works, completely unheated except for small coke stoves stuck away in odd corners, became so unbearably cold that the workers formed a deputation to make representations to the managing director The result was an uproar, during which the workers were flatly told that the way to keep warm was to work harder This had the effect of shelving the matter for a time, but when the weather grew worse the workers plucked up sufficient courage to again re-open the case To their surprise the managing director, after again storming for a period, suddenly subsided, and promised to give the workers all the heat they wanted Next day a number of labourers appeared upon the scene, armed with a quantity of steel plates Laying these down on the floor, at a spot almost in the centre of the open shop, they proceeded to build a huge fire Within a very short time the heat from the fire became so great that the workers nearest to it found it almost unbearable Despite this, however, the fire was kept at its maximum, being continually stoked, and fresh logs added As this continued throughout the day, late afternoon found many workers soaked in perspiration and incapable of any real physical effort Even so, the same thing happened day after day, until at the end of a week the workers had no alternative but to again appeal to the managing director The interview was decidedly hectic, the managing director stormed and raved, accusing the men of not knowing what they wanted First it was too cold, and then too hot—how could anyone possibly deal with such people Finally he only agreed to discontinue the fire provided no more nonsense was heard about the works being too cold The point was won, and from that date onward, until the company finally closed its doors, even the most severe winter failed to bring forth any provision for warmth

The problem of securing the right conditions for workers in industry does not, however, entirely rest with management To be conclusive—nay, in fact, to be workable—it calls for a far better understanding from the workers themselves No possible action on the part of the management can cope, for instance, with the kind of attitude exemplified in the following example, taken from actual practice

The building of a famous harbour bridge brought forth many acute, and also quite unusual, labour troubles The construction of the bridge was in a very advanced state, when certain of the workers walked into the manager's office and demanded a wage increase of so much an hour Asked for the reason, they explained that they were claiming 'wet money' because, being engaged on work on the lowest level of the bridge, their clothes were for ever being splashed with water In view of past labour troubles and the serious shortage of men, the advance was granted Shortly afterwards another section of the workers also demanded an increase Theirs, it transpired, was a claim for 'height money' which, it was contended, was fully merited on

the grounds that they worked on the highest point of the bridge. This also was granted. Within a further few days a third body made an appearance and likewise sought an increase in wage rate. Unable to offer any reason for the claim, the men were asked for particulars of the section where they worked. The answer being the middle tier of the bridge, the manager decided to try and humour them. He explained that he had already granted increases for 'wet' and 'height' money, but what possible valid reason could he have for granting an increase for work carried on in between the two and affected by neither. The reply was abrupt and to the point, "Call it part height money, and part wet—in fact, call it what the h— you like, so long as we get it." Get it they did, as the labour market was such that the company had no alternative but to pay.

The Enlightened Outlook

One thing is certain—that although an enlightened outlook on labour matters may not be general to-day, it must surely come. Gone for ever are the days of harsh treatment and complete lack of understanding, which were such a marked feature of so many plants of but a few years ago. It is, indeed, but a short step back to the time when conditions in at least one large plant clearly demonstrated that the management was devoid of even elementary knowledge of labour management. The responsibility in this case, as in many others, did not, in fact, entirely rest with the management, but with the people higher up, who, by failing to give a lead, permitted a state of affairs whereby not only were workers engaged and fired in almost endless procession, but even the satisfactory employee was 'played off' so continually for hours or days on end that at no one commencing time was he sure of securing a full day's work, let alone an economic working week. Worse still, the existence of such conditions allowed underlings their full fling in the perpetration of rank, bad injustices and an acute form of graft. To-day, in this same plant, there is a pronounced change for the better. In fact, a recent visitor, who knew the company in its bad old days, but had lost contact over the years, came away full of the fact that the present outstanding feature of the plant lay not in any one of its many excellent industrial services, or its first-class production set-up, but in its obviously happy and contented working force.

All can do the same, provided there is the will and the realization of the necessity. In fact, many who hesitate, or are slow in seeking improvement in labour management and control, do so because they are apt to forget that even in this machine-age personnel is still the predominant factor governing the success of any business. Its importance is, indeed, so well known and appreciated by industrial consultants, for instance, that none worthy of the name would entertain advising, say, a business overseas where it was impossible for the question of personnel to be studied first hand. They would refuse because they know only too well that any type of system or method ever devised is dependent for its success on the right use of personnel, the avoidance

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of square pegs in round holes, the use of certain qualities for certain types of work, and, above all, an all-round contented body of workers and staff

In many cases hesitation to move is due not so much to the absence of good intentions as uncertainty as to where to begin. Those in this position should note that experience undoubtedly proves that the task is primarily one for the directors of a business. It rightly falls in this sphere, in that the right handling of personnel is as much a part of a company's general policy as any other business activity. Important too is the fact that action at high level is necessary in order to provide the personnel manager with the correct amount of backing. It is impossible, for instance, to expect this official entirely to handle the matter when he happens to be distinctly junior to many other executives in an organization, and, although not exactly under their control, at least under their partial domination.

The plan of action which has proved successful in so many large and medium-sized companies has been based on the policy of making the personnel manager not merely a routine engager of workers and staff, but an official whose duties are primarily devoted to the main purpose of promoting the best possible public relations within a factory. In pursuit of this he tries to avoid becoming just an arbitrator on matters of dispute or complaint by always seeking out and removing possible sources of discord and lack of harmony before these actually develop. Even so, the main lead on labour policy, and certainly the most inspiring one, emanates from the directors. One director, preferably the managing director, should concentrate on making labour matters one of his chief functions. Any argument of lack of time is not valid. No managing director could possibly devote part of his time to any better purpose. Many appreciate this, as, for instance, the managing director of a very large organization, who, despite being one of the busiest men in the country, finds time not only to take an interest in labour matters, but actually to give a decisive lead in this direction. Instead of poring over details of cost figures, for instance, this very wise director goes out into the shops, and by taking a keen interest in the conditions under which his employees work, their difficulties, and even their private domestic troubles, produces a reaction which clearly shows itself in the cost accountant's next report. The benefits derived from such a course are so great that the practice can certainly be well and truly recommended to managing directors of all types of concerns.

The foregoing is of special interest to that multitudinous group of small companies which do not possess a personnel manager or his equivalent under the title of labour manager. While in their case routine labour matters of enrolment and records may be safely undertaken on a part-time basis by a staff member primarily engaged on other work, the main issue is certainly one for the personal attention of the managing director or his delegate. Having a great advantage over the employer of thousands by reason of the relative simplicity of maintaining close contact with employees few in number, it should not be beyond the powers of any one managing director to promote and maintain the best possible labour management within a given works or factory.

Incorrect Use of Workers and Staff

Labour management, of course, involves much more than the promotion of a satisfied working force, important though this unquestionably is. To be correct, it also calls for the very best use to be made of workers and staff. It is here that the average company goes astray. The incorrect use of people not only results in retarded efficiency, but produces the very discontent which efforts are directed to dispel. One important aspect of this incorrect use of workers is the little-appreciated, but very serious, fault of a company's placing itself entirely in the hands of a single individual. This occurs in a large variety of ways—by sole reliance being placed on a given executive, or a key specialist, down to a very minor and most humble servant. Although many companies would doubtless plead special and extenuating circumstances for failing in the first two cases, all would equally condemn corresponding failure in the third and last category, and yet this failure is very common. The point is illustrated by reference to an engineering company which employed some 600 workers. The entire position relative to this company's stores, and, in fact, all its complete records, were either locked up in the head of a certain store-keeper, a very elderly and infirm old man, or contained in a notebook which never left his person. This was true also of the keys of the stores, which travelled with him night and morning. The practice immediately ceased, however, when the directors of the company were asked what would happen if the old man was ever unlucky enough to meet with a fatal accident on his way to or from work.

One of the most damaging conditions which any progressive-minded company can possibly allow to occur is that where ambitious workers, both of the staff and the rank and file, are given the fixed impression that progress and advancement for them is purely and simply a case of waiting for 'dead men's shoes'. True, no company can afford to 'make' jobs, but all should keep an eye to the future. How often, indeed, is it a case of confusion when a replacement is suddenly needed to fill a vacancy created by the death or retirement of a long-service staff-member and there is no one to fill the breach, as those who could have fitted admirably have left the company, often to hold key positions in the employ of a company's greatest competitor. The failure, indeed, of a one-time highly successful machine-tool company can be traced to the managing director's stock phrase of "Let them go—they'll be back." At the present day there are many companies who just manage to struggle on year after year in a hand-to-mouth existence, and who are badly in need of able executives to modernize their places throughout, and are in the unenviable position of being able to claim that some of the best executives in the country received their early training in their employ.

The most common failing in regard to the use of workers is the persistent 'backing the wrong horse'. Just as some companies seem to make a speciality of choosing the wrong type of manager or higher executive, so others repeatedly stick to the wrong types of superintendents, foremen, charge-hands, and the like. Usually the faulty

choice errs on the side of lowness of type, the failure to reach a necessary standard of mentality, rather than the equal unsuitability of candidates with qualifications to the other extreme. In general a company's failure in one or two instances can be borne, but where many of the works staff suffer in this respect trouble is bound to ensue. This, indeed, was practically the sole source of trouble in a company connected with the gas trade, which ran into serious difficulties not very long ago. Here every other one on the works staff was decidedly lacking in general mentality and intelligence. The only real improvement made in this business, in fact, and which was responsible for lifting it in a very short time to the forefront of the trade, was the replacement of a goodly number of works officials by men armed with sufficient mental make-up to understand and appreciate modern methods and the rudiments of costs and business economics.

A study of the "situations vacant" column in the average daily newspaper will usually provide glaring instances of how companies set out to cripple the very potentialities of staff by expecting far too much. Although, as far as is known, no one has yet proceeded to the extent of advertising for a foreman-secretary-managing director, many have, indeed, approached very near to the mark. The non-advertiser who is inclined to smile had needs first make sure that the principle of over-saddling people with duties and responsibilities is not present to some extent in his own business. It is, indeed, a very common error to commit. Only quite recently a company of considerable repute offered a comparatively small salary for a man to fill a completely unclassified position, and to be personally responsible to the managing director for the activities of purchasing, sub-contracting, works planning, production control, rate-fixing, and time study. This entirely misplaced interpretation of economy is a practice which is not only affecting the present-day general well-being of many concerns, but is also undoubtedly responsible for putting a decided brake on the attainment of the correct measure of development.

Much of the incorrect use of workers and staff is the result of a failure to define duties and responsibilities correctly. Serious trouble frequently arises through someone's hesitancy to proceed with a duty which he feels is not clearly his for fear of either treading on somebody's corns or of being accused of assuming too much power or authority. In short, the real value and initiative, of the highest to the lowest, is often killed in this way. As a rule managements are guilty of dodging giving terms of reference in respect to duties, either because of lack of sufficient experience on their part to be able to define correctly the scope and extent of a number of different activities, or alternatively because of a fairly prevalent belief in industry that a person's usefulness depreciates by being confined to spheres of activity within certain lines of demarcation. It should not be necessary to stress that efficiency can only come from each and everyone's being fully aware of his or her duties, the sphere of operations or the details concerned, according to the rank and position held, and a perfectly clear understanding of the extent of the responsibility carried.

The achievement of the maximum possible efficiency, however, involves more than the correct definition of duties. It makes essential the use of the right type of worker for each and every different task. The person ill-suited to a specific role, either by type, mentality, or inclination, can never do justice to himself or the job.

Psychological Understanding

It is indeed but a few short years ago since industry began to realize that while it gave considerable thought to much of its activities, and dwelt carefully and long, for instance, over the selection of machine-tools and equipment, or the choice of systems and methods, it gave little, if any, thought to the types of people who would be required for their operation. With this awakening came the usual aftermath—namely, a period of craze for excess. This showed itself, and still does to-day, in a far too great an advocacy for the use of psychological tests for the selection of workers and staff. Useful in certain very confined spheres of application, the psychological test represents by no means the value to industry that some would have us believe. The people who are mainly responsible for advancing these claims, and who would have every large employer of labour make use of the practice in a very big way, are mainly those with a very limited experience of industry, and completely unaware, except in a very superficial way, of what really does go on within the four walls of the average works or factory. Holding but a vague idea of the procedure and action involved in placing an order in the shops, and progressing it through to completion, and of the manifold problems and considerations involved at every stage, they are singularly ill-equipped to venture forth as determiners of the qualifications of those who shall undertake these many diverse activities and operations.

The claim that the use of the psychological test is magnified out of all proportion to its real value was more than borne out by the result of extensive research undertaken in Great Britain during war-time. The facts thus derived, indeed, produced damning evidence to show that not only were many of these tests completely useless for the purpose for which they were intended, but, moreover, if used to any appreciable extent in their present form might possibly have dangerous repercussions on the future well-being of industry. One conclusion was most evident—namely, that had psychological tests been enforced with regard to war-workers in general thousands of women-folk and dilutees of all kinds would have been definitely barred from the very tasks on which they achieved miracles from 1939 onward. Indeed, of over a thousand of the country's best and leading productive workers tested in this way, 79 per cent completely and utterly failed to pass the recognized test for the type of work on which they had proved so outstandingly proficient. Possibly even more conclusive was the fact that four women workers, who had achieved outstanding distinction for amazing output and quality of work, and who were, in fact, holders of unbeatable records in their respective spheres, also failed to pass when tested within a very short period of their breaking production records.

Not very long ago a leading industrialist conducted his own researches into this question of psychological tests. He chose a test of the cardboard-puzzle type, which among other things is deemed as being a means of determining alertness and a fair standard of mentality, and arranged for four people to be so tested. The people chosen were a college professor, a leading accountant, a production engineer, and a labourer of very poor type and exceedingly low mentality. To the surprise of all, save possibly the industrialist, the labourer won in a canter. He did so, not because of the lesser alertness or degree of mentality of the others, but because the fitting together of jig-saw puzzles happened to be his one and only hobby. Herein lies the real fault of the average psychological test as it now stands. It simply shows aptitude for the actual test itself, not the holding of any special qualities. A period of short training to candidates under examination will in nine cases out of ten result in a complete reversal of the results of the original test. This has been proved over and over again, even on the very type of work for which the psychological test is presumed to be especially fitted. Candidates who, beyond a shadow of doubt, have been proved by tests to be entirely unsuitable for packing operations, inspection, sorting, and a wide variety of pursuits calling primarily for specific qualities such as powers of concentration, numbness, thoroughness, dexterity, etc., but who have nevertheless been engaged, have repeatedly turned out not only to be exceptionally good at this work, but far and away superior to those whom the original test classed as A1.

Maybe improvement in the psychological tests will be forthcoming, although even this may not be desirable, because the setting of tests is in reality a continuation of the educational-examination principle, which has by no means covered itself with distinction up to now. Tests such as these do not allow for examination nerves, nor for the important fact that people do not awaken mentally at the same age. Industrial experience, in fact, proves that the dull youngster, for instance, does not necessarily stay dull, but can and does suddenly blossom forth with a standard of mentality far beyond anything previously shown.

The real solution to the problem of using workers correctly lies not in determining the suitability of raw candidates at the time of engagement, but by wise handling and careful training on the actual job. Those who support the use of psychological tests on the grounds that it is far wiser to determine capabilities at the outset, and so prevent a period of trial and error at some later date, appear to be ill-versed in the extent and scope of modern labour-training methods, and what is possible of accomplishment in this direction. When the story of war-time production comes to be written it will be made very evident that not only were the training schools of works and factories largely responsible for the immense bulk production which later followed, but that the scope and measure of the individual achievement was sufficient to confound the critics repeatedly, and prove a never-ending source of amazement to managements, engineers, and trade unionists alike. Over and over again was it shown that the most insignificant, humble female dilutee could be trained in a very short space of time to

undertake most successfully a large proportion of even the most highly skilled of operations. Numerous were the cases, indeed, of work which had hitherto been considered as only possible of execution by a high-class skilled worker falling within the scope of the ordinary housewife and her fellow dilutees. This truly amazing state of affairs became possible because the hour of necessity brought forth a radical change in outlook on this question of fitting the worker to the job. It came to be realized, in fact, that the correct performance of work did not call for the holding of any special qualities on the part of the trainee, but was largely a question of familiarity borne of correct training along a carefully conceived plan. What had been achieved, in fact, was that the demand of the times had simply caused a quickening of a realization towards which industry had been drifting for many years—namely, that the job must be brought down to the level of the lowest-graded worker, not the highest. It could not be otherwise, for here, indeed, lies the basis of all true manufacturing progress, which is the achievement of the perfect fool-proof process. It is ridiculous to conceive that plans for the future should allow for industry or any one factory to be placed in a position whereby it is utterly dependent upon possessing so many nimble-fingered workers, so many with an outstanding spirit of alertness, others predominantly methodical, and so on. God help a factory's flexibility if that ever became the rule. The very idea, indeed, is contrary to all sense of organization, which aims to so simplify work and arrange matters that workers must produce satisfactorily despite themselves or their passing inclination of the moment.

If any given factory is entirely dependent upon its workers' possessing personal attributes of one type or another there is something drastically wrong with the mode of manufacture. Scores of instances are repeatedly found on packing and assembly operations, where the need is not for psychological tests to provide the correct types of workers, but for drastic improvement to the processes which stipulate these requirements. As a case in point, a large company which employed hundreds of girls on hand assembly work was for ever in trouble with its production. The main cause lay in the fact that the labour force was not constant. Girls who had been hard to obtain in the first instance, and on whom considerable time and effort had been spent on training, were for ever leaving, either to get married or to seek better and more congenial employment elsewhere. As a consequence the department was continually short-staffed in experienced workers. This was bearable so long as the supply of new recruits of the right type lasted, but when this too began to fail the position became so bad that something just had to be done. It was, the process was studied, and within a very short time it was found possible to 'jig' the work so completely that not only could it be carried out by anyone with two arms, but output was more than trebled in the process.

Psychology as applied to industry, however, has a far wider and much more profitable scope than its application to the engagement of workers. It achieves its best results, and serves its main purpose, in fact, when applied to existing personnel in

promoting that type of effort which is untouched by any organization, system, or method, and in smoothing out and controlling those problems of human nature which arise wherever people congregate together. It is here that it finds its real level, and serves such an invaluable purpose that no business can possibly afford to discount it. The wise company, in fact, absorbs the teachings of psychology into its very policy, and makes it an integral part of its conduct and dealings not only with employees, but with customers and public alike. Its sphere of application within the factory is, of course, wide and varied, ranging from the need to deal with Mrs. Smith's objection to working next to Mrs. Jones, the handling of intricate and delicate staff problems, to an understanding which, by catering for human considerations, prevents discord and obtains the best out of people by welding all concerned into a team in which each plays a part and has equal opportunities for advancement and progress along the right lines.

To illustrate all of these different angles by examples taken from actual practice would involve such an amount of matter that it is not a practicable proposition, at least as far as this book is concerned. Nevertheless, it is felt that the idea can at least be conveyed by reciting one instance where psychology was responsible for overcoming a very difficult position and achieving a most worth-while result. The example concerned is taken from an engineering company employing some 1500 workers. This company, owing to lack of adequate organization, had fallen on very evil times. Matters became so bad that eventually a company of industrial consultants was engaged and given the task of investigating matters and submitting a report. This, when produced, showed such conclusive evidence that the company could be reasonably quickly organized to a satisfactory state that the consultants were given instructions to proceed with installing the necessary organization on the lines recommended. In due course a production organizer arrived to attend to matters in the works. From the outset, however, his task was made extremely difficult by the attitude adopted by the works superintendent. This individual, an overbearing type, went out of his way to make it quite clear that no help could be expected from him, as he did not believe in new-fangled ideas of organization. This would have been immaterial, but unfortunately the refusal to help came to be translated into active opposition. Normally deliberate obstruction of this type would have brought forth warnings, which, if ignored, would have involved dismissal. In this case, however, seeing that there were very special reasons why the latter course could not be pursued, there was no alternative other than to win the man over to the right view-point. To that end, therefore, the production organizer devoted no little time to attempting to gain the superintendent's confidence. This was all to no avail, however, as not one single line of approach succeeded in bringing forth even the slightest response. As time went on, and the moment drew near for the change-over from the old to the new methods, this attitude of the superintendent's became a most acute problem. Won over he had to be, if the very success of the whole scheme was not to be endangered, yet how to do it remained just as unknown as ever.

Turning the matter over in his hotel one night, the organizer came to the conclusion that it was definitely a case for the use of psychology, but the problem was to find the right avenue in which to exploit it. By good fortune this chance came next day. Overhearing the superintendent discussing dog-racing during his lunch-time break, the organizer decided that here, indeed, was the very thing which might do the trick. Consequently on the way to his hotel that night he purchased every paper, magazine, and book on dog-racing which the bookstalls had for sale. That night, and, in fact, for the next three nights, he devoted his entire evenings to the task of mastering all he could about the sport, studying all the various angles of the matter and cramming his head with every possible detail of the form book. Feeling at the end of this time that he knew sufficient of the subject to enable him to satisfactorily enter into reasonable conversation with an ardent adherent of the sport the organizer decided to try his luck. Next day his mentioning during casual conversation with the superintendent that he was interested in dog-racing brought an immediate effect. As if realizing for the first time that the organizer was a human being after all, the superintendent began to chat, hesitatingly at first, and then with increasing interest as he warmed to his favourite subject. Before they parted it was agreed that they would spend an evening together at a local dog-track.

For some seven evenings, in fact, the organizer accompanied the superintendent to various dog-racing meetings and afterwards to a local hostelry where invariably an inquest was held on their losses, or a clear and prolonged discussion ensued upon the value of the superintendent's winning tips. It was following one of the latter detailed explanations that the superintendent suddenly gave vent to something like the following: "Look here—I think that I've had you all wrong—and possibly your methods too. You're not a bad sort at all. What do you want doing in the works? Just say, and I'll see that it's done all right." From that moment the point was won. Thereafter the superintendent's opposition completely disappeared, and in its place came a decided and marked eagerness to help. Being by no means a poor or inferior type of fellow, his help was, in fact, a decided acquisition and played no small part in achieving a most successful change-over and the progress which the company made from that date onward. Although probably not aware of it, the superintendent himself improved vastly in the process—so much so that to-day he has considerably higher status in a now flourishing business, fast making a decided name for itself as a most progressive, up-to-date concern.

The Right Approach

As with most worth-while matters, there is no short cut to success in questions of personnel. To be handled correctly, and especially to provide for the future requires a solid foundation on which to work. The true basis for this is training. Those who have achieved decided success in matters connected with the human element

have found that it is possible by this means alone. Training, in their case, is by no means a confined and restricted field of activity, but covers a number of different courses of action, all of which are conjointly directed to improve the education, experience, and conditions of both workers and staff. It forms three broad classes—namely, training for apprentices, which is of both a practical and technical nature, secondly that undertaken on behalf of the ordinary adult worker in the shops, and lastly management training for specially picked likely executives of the future. Although many British companies have ventured to some extent in the first category, few, indeed, have even considered action in regard to the second and third. One has, indeed, to go overseas to find instances of excellent results which have accrued from foresight of this type. Immense strides have been made in U.S.A. and in many Northern European countries, for instance, in regard to training executives of the future. Unlike their counterparts in Great Britain, business organizations in these countries have long realized one very important fact—namely, that while every known class of worker in industry or in business, ranging from the essentially practical worker to the highly qualified technician or to the purely professional man, have had to undergo prolonged and specialized training to befit them for their posts, and subsequently have had to show proof of knowledge thus gained, the rank of managerial executive provides the one outstanding instance which has been exempt from these conditions.

It is with due recognition of this undoubted need for training in the function of management that many companies in the countries named have taken decided steps to try and provide the necessary link. The ruling practice is not to rely on the benefits of management courses at some local college, but to undertake the training in their own works and factories. To that end suitable candidates, specially chosen for the purpose, are given an intensive training in readiness for the day that their services will be required in a managerial capacity. The training commences at the bottom of the ladder with practical experience in the shops in conjunction with technical training in the works school. Given this basic knowledge, and the attaining of a certain standard, candidates then progress through all office and works departments in turn, acquiring, on their way a knowledge of costing, time study, planning, production control, etc., and, in fact, of all activities with which a managerial executive should be rightly familiar. Finally, suitable and successful trainees are given a two years' course on works management and factory organization. The finished product eventually blossoms forth armed not only with requisite practical and technical training, and an all-round experience of business functions, but, in addition, with the very valuable asset of an intimate knowledge of a business which at some future date he may be called upon to manage entirely.

Training undertaken in regard to the ordinary adult worker of the factory usually follows the course of befitting him or her to attain greater proficiency on the job, and at the same time providing a nucleus from which the charge-hands and foremen, etc. of the future can be drawn. As such, although it is not training in the recognized

sense, as, for instance, by classroom or specific course, it is none the less real. Training in this case is, in fact, represented by the attention and guidance given to all productive workers during the day-to-day ordinary course of their work. In factories where it operates it is immediately recognized by the extraordinary care and attention given to each individual operative. At all times, indeed, is the progress of workers watched and guided by the supervisory staff, with support from the time-study department. Herein lies the greatest departure from hitherto-accepted understandings of supervision. In the plant with advanced labour management supervision is more a question of helpful coaching and guidance than merely keeping people at their work. With the system established, workers are indeed quick to respond to it. They do so because they are not slow to appreciate that where this spirit exists time study has a different meaning, and that improvement sought in production times is obtained primarily by lessening of their fatigue. A further reason is the fact that it comes to be recognized by all that ability does not go unrewarded, and that opportunity for progress and advancement is open not to the few, but to all and sundry. In plants run in this way it is by no means uncommon to find that officials such as the works manager, the cost accountant, and the chief estimator, to mention but a few, are one-time production operatives of the factory who have succeeded in advancing stage by stage to their present high position.

One of the greatest mistakes of British industry in modern times has been its failure to harness the organizer to the task of running a business. In this it is fast becoming the exception among industrialized countries. Others have found, as British industry must, that not only has the organizer a rightful sphere in industry, but is, indeed, essential to its proper furtherance. Running a modern enterprise creates a demand not only for the services of the technician and the administrator, but for the outlook and valuable gifts of those with organizing ability. To use, as many British companies do, the pure technician, the metallurgist, and, indeed, even the scientist to manage and control activities far removed from their training and background is not only a sheer waste of good talents and valuable knowledge, but is in itself a decided handicap to the best advancement of a business. The greatest offenders in this direction are the large and medium-sized concerns which still cling, for instance, to the use of the purely technical man in such posts as works manager and purchasing manager, despite the fact that these categories essentially call for powers of organization, not technical knowledge and attainment.

Many are the British companies, indeed, working in all types of material, which suffer for want of the ability in the organizer to co-ordinate the efforts and skill of the craftsmen and technicians in their employ. It is abundantly obvious on all sides in the large engineering works, the iron, steel, and aluminum foundries, the large woodworking plants, and, in fact, wherever industry is carried on in any magnitude whatsoever. The greatest culprits, however, are the engineering and allied trade concerns, because, while a certain trend in the right direction is occurring in many

CHAPTER X

COMPARISON WITH COMPETITORS

DESPITE the well-known saying that "comparisons are odious," there is no finer pursuit that any manufacturer could possibly follow than periodically to sit down and take stock of himself and the other fellow. In business circles the value of comparison is so tremendously important, and the advantages to be gained from it are so great, that not only is it a course to be greatly recommended, but it is, in fact, indispensable, being, indeed, the source from which all true progress springs. The manufacturer who pursues his way entirely unconcerned with what others are doing comes sooner or later to an abrupt halt. It is only by 'cashing in' on the experience of others, by taking advantage of modern progress and developments, and by profiting from the mistakes and successes of the business world in general that one can hope to pursue the correct and proper course.

By 'competitors,' however, is meant not only the firm around the corner, across the street, or even in some other town, but those also of other nations, who, being likewise engaged in manufacture, may have something to offer from which benefit can be derived. Indeed, so much can often be gained from the latter source that consideration of foreign methods should not be excluded from the reckonings of any concern, irrespective of size or whether it be engaged in export trade or not. Many are the cases, indeed, where even the small company, by keeping an eye on overseas methods, has managed to pick up a wrinkle or two, often from a type of manufacture far different than its own, which has proved of excellent advantage if not of actual salvation. If this outlook is necessary to the small company it is much more so to that vast range of medium-sized and large concerns, on whom Great Britain as a nation is so utterly dependent for the securing of a measure of export trade sufficient to maintain its economic position and find employment for its workers.

General Considerations

From investigations made into the workings of a wide range of companies of all sizes and types of manufacture, it is evident that one of the chief reasons for the successful company's advantage over competitors lies in its ability to manufacture correctly. This fact is true of the manufacture of all types of goods, including the most minute of articles, the uncommon product, the luxury article, and all other articles, from those of common every-day use up to the mighty and complicated product of modern science. That many companies fail to manufacture correctly is simply

the result of an incorrect attitude to the problem, which allows them to say to themselves, "But such and such a company can't be any different from ourselves, they must have to machine, wash, bend, roll, or cut, just as we do." But do they?—that's the point. Maybe all the companies within a certain company's knowledge may manufacture on similar lines to themselves, but somewhere in the trade others have found and exploited entirely new methods for producing the same articles in a vastly superior and cheaper way. True, every successful company does not have its own special or secret processes—the world would probably come to an end if they had—but at some point or stage in the methods used there is usually just that little difference which does the trick. Maybe it is a change in sequence of operations, and not of type—but one or the other it usually is. This point was more than amply illustrated quite recently, when an engineer from an old-fashioned engineering works paid a visit to the most modern engineering plant in Great Britain. When asked for his impressions of the place he frankly admitted that he was disappointed because the company had nothing revolutionary to show: they just turned, milled, and cut parts the same as anybody else. Of course they do, but in the set-up, in the sequence of operations used, and in the tooling, is that world of difference which puts the company in the forefront of the first half-dozen engineering companies in the world, and which would enable them to produce the same goods as those of the visitor's company at a fraction of their present cost.

A company, to be really progressive-minded, should take nothing for granted. It should constantly ask itself if its existing mode of manufacture is correct. On no account should it rest itself content with a given method merely because it has always been the practice to do it that way. The really progressive company, the one which is for ever stealing a march over all competitors, is the type of company which is never completely satisfied with its manufacturing methods, but is perpetually searching round for improvement. It continually seeks the answer to questions such as "Is this really a washing process after all, or is not some other way the better method? Is it not, for instance, really a steaming process, or would not heat applied under pressure achieve the same result but in an infinitely faster and cheaper way?" When the answer at the moment is no it then seeks temporary improvement from the process, to serve until such times that advanced knowledge makes it desirable that the entire question again be reopened. The up-to-date woodworking business, for instance, seeks for new and better methods of cutting timber, exploiting the maximum of multiple tool-cutting in place of single, even to the extent of specially designed machinery for the purpose. Where the latter is not possible, or during the process of its being evolved, it seeks for immediate effect by achieving some measure of automatic feeding to machines. It is on these lines that manufacture is considered by those who seek perfection in performance, and the many and varied benefits which accrue from the gaining of the status of a highly competitive concern.

At Home

Many small to medium-sized concerns often express envy of the good fortune which appears to attend the activities of the Jewish-owned business. Much of this success, however, is not so much good fortune as good business. Indeed, contrasting the average enterprise with one so owned, it is evident that the latter has much that can well be copied, not only by its competitors, but by the entire business world. Probably the outstanding prosperity of the average Jewish-owned manufacturing plant, is due to the possession of two very marked and worthy features. These are its contentment to be satisfied with a small margin of profit, relying on turnover to do the rest, and the accessibility of its managing director. The latter is by no means the small point it would first appear. Indeed, the approachability of the Jewish managing director is a factor which is undoubtedly responsible for many benefits. It enables him to maintain the best possible contact with all that is happening not only inside the business but also without. Those, for instance, who have ever sought an interview with the average English director, and compared the experience with the ready admittance granted by his counterpart in the Jewish-owned enterprise, will appreciate just why it is that the man with something to offer, the man with ideas, invariably seeks the latter source first.

One very real factor behind many a company's inability to compete is the amount of loss incurred in the production of waste and scrap. Usually the former is the greater evil of the two, because, while actual scrap is to some extent obvious and can, therefore, be checked, wastage—that loss caused by bad cutting or the use of wrong sizes of materials—often flourishes completely unnoticed and in directions where least expected. As the cost of material in the average run of product represents by far the largest proportion of the total selling-price, any excessive percentage of loss in this direction plays havoc with a company's costs. Indeed, as this waste is usually undiscernible, and, therefore, completely uncatered for by any margin in the selling-price, a high rate of loss often has the effect of turning an expected profit into a substantial loss. The result is usually a headache to the owners, directors, or management of a company, who after repeated checking and rechecking of the labour, material, and overhead figures involved, still finding these correct on paper, begin to wonder if they do after all really understand the elements of manufacturing costs. The usual reaction to all this is that the old bogey is uncovered, and, under the plea of keen competition, an attack is made on the scale of rates paid to workers. Many are the cases, indeed, where the origin of labour troubles can be traced to unjustifiable attempts at reduction of piece-work rates, brought about by a company's inability to trace sources of loss to such factors as excess wastage of material.

Many cases have been encountered of small companies experiencing hard struggles to remain competitive, on account of the incurring of heavy transport costs. This state of affairs has been most marked on cheap-price lines, where a copper or two per

article makes all the difference between profit and loss. In these instances it has been found that the practice of a given company in operating its own transport vehicles, especially where these have been employed on an intermittent basis to deal with rush-orders, has been sufficient to turn the scales and lift up a company's indirect expense to a figure well above that of its chief competitor.

A number of companies in the ironware trade could not fathom why it was that, despite the very hand-to-mouth existence of most of them, at least one in the group did extraordinarily well and never failed to produce a substantial profit on any year's workings. The secret was that the company referred to, unlike its competitors, undertook the distribution of its own products. That it did so was the result of chance.

6 ^d	1/-	1/6	2/-	2/6
MATERIAL 2/-				
LABOUR 1½ ^d				
OVERHEADS 1½ ^d				
TOTAL FACTORY COST 2/3 ^d				
SELLING PRICE 2/5¾ ^d				

The Company's Estimated Cost

6 ^d	1/-	1/6	2/-	2/6
MATERIAL 2/-				
LABOUR 1½ ^d				
OVERHEADS 1½ ^d				
TOTAL FACTORY COST 2/6 ^d				
SELLING PRICE 2/5¾ ^d				

The Actual Cost

FIG 20 LOSSES BY WASTE CUTTING

An example from actual practice of how the waste factor was responsible for a company actually losing money on each article produced

It came about through the company's happening to note from a newspaper advertisement one day that one of its products, which it made solely to the order of a mail-order concern, and for which it received twelve shillings and ninepence each, was re-offered for sale by the latter business at a price nearly three times as high. From that moment onward the company set about organizing its own distributing agencies. The outcome was that by thus dealing direct with the consumer, instead of through mail-order channels, the company obtained a turnover which not only made possible a much lower selling-price to the general public, but also permitted the company to work on a far greater margin of profit than previously.

One reason why many companies fail to prosper to a satisfactory extent is purely and simply a lack of enterprise in their manufacturing policy, which restricts them to the production of articles in penny numbers. Especially is this noticeable in such trades, for instance, as those manufacturing electric fittings and appliances. A comprehensive policy in respect to the manufacture of many of these goods would permit of their production at a fraction of their present cost. To do so would by no means

involve large-scale mass-production, as a process of getting down to the job could be easily accomplished on many lines if only reasonable quantity-production was pursued. The benefits which would accrue from such a policy would be enormous. Not only would a drastic lessening of price automatically create a tremendous demand in the home market, but it would also make possible the sweeping of the entire world market.

It is not just a single type of attitude which is responsible for this lack of enterprise, but, indeed, a number. On the one hand there is the type of company which still puts the cart before the horse by expecting quantity to come to hand before reduction in price is achieved. Then there is the kind which looks upon many branches of production as being side-lines to its main and more profitable products, and, therefore, not to be taken too seriously. Lastly there is the by no means uncommon type of company which sees no point in embarking upon larger-scale production, and producing more cheaply, while the present method permits such a good margin of profit to be made on each article produced. This latter kind of attitude often produces most astonishing reactions. It was a managing director of a smallish electrical company, for instance, who, in order to strengthen his arguments against producing more cheaply, put forward a point of view which is astounding in this day and age. He explained that when in 1938 his company reached a point when orders just could not be obtained he met the situation by merely changing the description of certain goods and greatly increasing their selling-prices. This, he contended, had the desired effect, because articles which had not been favoured by the public when offered at a certain figure proved to be of great demand when offered at a much higher price. Although fortunately this actual juggling of selling-prices is not common, it nevertheless serves to indicate the extent of the progress which more than one British company has yet to make. Between this type of company, however, and those at the other extreme, the highly competitive efficient concerns, exists a vast range of works and factories in which this question of price has yet to be tackled in a truly comprehensive and keen manner. In some the issue is small, in others relatively big. Improvement to some extent, however, is possible in all.

In order to gain the right view-point on this question of price, it is worthwhile to contrast, for instance, the work and effort involved in producing, say, a hundred-pound motor-car with that required for producing many comparatively simple standard articles whose selling-prices are even in excess of this amount. If companies were to adopt this instance generally as a yardstick or as a goal at which to aim, even the most liberal allowance for the handling of lesser manufacturing quantities would not forbid a most marked reduction being achieved in the selling-price of many articles on the market at the present day.

Of five companies engaged in a certain branch of the upholstery trade, four led very hand-to-mouth existences. The fifth, however, was a decidedly profitable and successful business. In the factory the methods of the five were so similar as to be almost identical. In the office, however, there was a very marked difference. The successful

company employed an office staff of ten people for some 350 employees, but the others, with decidedly less work-people on the pay-roll—the highest of the four having only 180 hands—employed some 30, 25, 25, and 20 respectively

The General Overseas Market

A general comparison of manufacturing methods in Great Britain with those in operation in the best industrialized countries overseas proves beyond doubt that, while Great Britain is far and away above all-comers in the production of the non-standard design, the article which requires no mean amount of skill and ingenuity in its construction, it begins to lose this lead as soon as quantities enter into the picture, and to fall sadly in arrears as large-scale production is approached. There are of course, exceptions, some companies in Great Britain undertake large-scale production in a manner which does not suffer in comparison with any in the world, but from the point of view of industry as a whole the position is as stated. That Great Britain leads so handsomely in the production of the single article of involved and intricate design is a decided tribute to the creative powers of its designers, and the skill and undoubted sense of ingenuity inherent in its craftsmen. That it correspondingly fails as quantity production enters the picture is the result of faulty manufacturing policy, lack of requisite organization, and a complete failure to offer to its production engineers anything like the support and scope to which they are entitled. There indeed, is the true picture—Great Britain has the best craftsmen and technicians in the world, but fails to commercialize their value by refraining from organizing to anything like the extent of its chief competitors overseas.

This conclusion is by no means just a personal one, or the result of hasty decision. It is the considered findings of not one person, but of many who over a long period have carried out the most thorough investigations into British manufacturing methods as compared with those of other countries, seeking not the exception, or support for theorized findings, but a truly comprehensive picture based on fact. To this end, and in order to make the survey as representative as possible, comparisons were carried out between British and foreign factories over a range of different-sized plants in various sections of industry. To ensure a truly common basis of comparison—one unaffected by any variation in the different countries of such factors as rates of pay, overheads, profit margins, etc.—the medium of assessment chosen was the number of man-hours required by each country to produce a specially selected range of articles in varying quantities. The latter ranged from the production of a single article, the making of small quantities, medium-quantity production, up to a full state of mass-production. The comparison was in all ways thorough in that the utmost care was taken to select articles of almost identical design in all the countries concerned, and to provide a correct allowance for those variations which did exist. Wherever possible the figures used were those of the man-hours taken in actual practice to produce a

specific order Where in certain instances this was not possible the figures were those which a company had used to produce its own estimate So many, indeed, were the precautions taken to avoid the possibility of error creeping into the picture that if any does exist in the final findings it can only be an infinitesimal amount, and certainly in no way capable of affecting the issue one way or the other Especially is this so, seeing that the difference between the countries at the various manufacturing quantity levels is so clear and distinct, and covers no mean variation in the amount of man-hours involved

It should be noted that the illustrations used to portray the results of these investigations are confined purely and simply to examples taken from the engineering trade This is so because, while the chosen articles submitted to test were drawn from engineering and its allied trades, woodworking, sections of the leather industry, and, in fact, all representative branches of industry dealing with 'built-up' products, the results obtained in all sections were practically identical with those found in engineering This fact did not surprise the investigators, who, being men with intimate and all-round knowledge of most sections of British industry, had long held the opinion that, from a production point of view, what was true of one branch of industry was more or less true of all

The first conclusion to be drawn from the results is the indisputably clear and decisive fact that Great Britain is undoubtedly pre-eminent in the production of the large single construction of involved design, such as the ship, the bridge, or the outsize in power-station plant, etc Equally clear, too, is the fact that she holds a similar lead in the production of the single article of smaller size, or, in fact, any size or type, of material where the construction is involved and requires no mean amount of skill and ingenuity in its production British industry continues to hold this decisive lead while the quantities involved remain comparatively few in number As the quantity grows, however, so the lead lessens, until it eventually becomes a decidedly adverse ratio The point at which the lead is actually lost varies according to the product, but in general it occurs at the point where the total money value of the goods is sufficient to allow tooling and sectionalization to be undertaken Where, for example, an order for 100 ships of the same size and design may allow this to be done, it may possibly require an order, say, for 5000 of a smaller article to enable the same purpose to be accomplished Wherever this point may occur, however, the fact remains that the entrance of really substantial quantity production causes British industry to begin to fall badly into the rear This proves one thing—namely, the failure of British concerns to tool, to plan, to sectionalize, and, in fact, to organize to anything like the same extent as their overseas competitors The fault lies not with the country's technicians, but with those heads of companies whose general reluctance to forsake the principles of production of a jobbing nature is an ever-present hindrance to the promotion of that state of affairs which is so vitally essential to any attempt to capture and hold the markets of the world

At one time the stock reply to any criticism of British industry in comparison with U.S.A. enterprise followed the line of begrudging reference to the very good fortune of American business in being able to deal in large quantities through having such a large population to supply. Surely, however, this no longer applies to-day. The British Empire, Russia, the Far East, and the many essentially agricultural countries of Europe offer more than ample scope for even the most ambitious schemes of quantity-production. No! the opportunity is ample, provided there is the will. The time, however, is now. If British industry puts its house in order at once then its future—and, in particular, the best negotiation of that essentially trying period of transition, the early post-war years—is already fully assured.

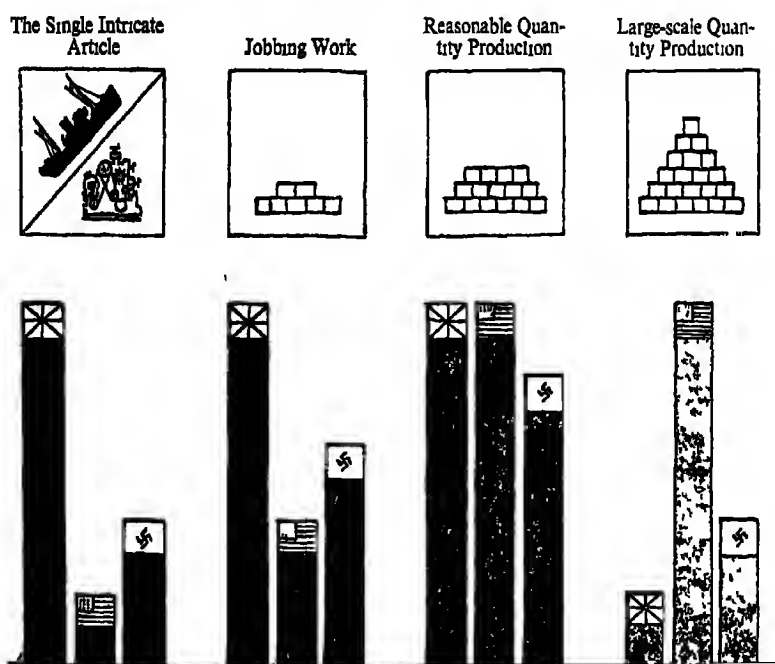


FIG 21 COMPARISON OF GREAT BRITAIN, U.S.A., AND GERMANY ON THE PRODUCTION OF THE SINGLE INTRICATE ARTICLE, JOBBING WORK, REASONABLE QUANTITIES, AND LARGE-SCALE QUANTITY PRODUCTION

U.S.A.

Probably the best way to deal with the outstanding difference between American and British manufacturing methods is to illustrate it by means of an example from actual practice, which gives conditions typical of both countries. A few years ago a British electrical engineering company and a similar American concern happened almost simultaneously to market an electrical equipment of practically identical design and performance. The only real difference between the two units was that

of price This was heavily in favour of the American-made article In fact, the selling-price of the latter was less than half that of its British-made counterpart Naturally this had the effect of quickly freezing the British product right off the market As this kind of thing had happened so often previously, and was more than likely to occur again on more than one occasion in the future, it was of considerable interest at the time to more than one student of organization It was not until a year or so later that contact was made with two individuals, one from each company, that the real answer was obtained The story was, in fact, a description of the different methods adopted by the two competitors

Taking the British company first, the course of events was as follows The technical designers of the British company having completed their work and produced on paper a design which the directors considered as having excellent commercial possibilities, the order was given for a sample to be produced in order that all necessary tests could be undertaken With this made in 'tool-room fashion' the sample finally emerged as a first-class-quality article, complete in every way to specification, which subsequently easily passed the various tests to which it was submitted, registering in each a standard of performance which completely substantiated the claims of its designers In view of the success of the tests it was decided to go into production This decision led to an order being given to the works production department to manufacture a quantity of 250 Determined to maintain in every way the quality of the sample which had proved so successful, the production department had all the various components for the 250 products rough-machined in the machine-shop, leaving a tolerance on all dimensions for the tool-room to finish to size By manufacturing under these conditions, the quality of the approved sample was fully maintained, and the 250 articles, when finally completed, were perfect replicas of the original sample These were then placed on the open market at a selling-price of approximately £40 per unit—a figure which carried only a normal margin of profit and which was determined purely and simply by the works cost involved in producing the total quantity

The American procedure, however, was vastly different Here the designs, after being approved and tested by a 'knock-up' model, were immediately passed to the sales department with a request for advice as to market prospects and price The reply being to the effect that prospects were good if marketed at about £18, the designs were then submitted to the methods and planning sections to view for simplicity of design from a manufacturing point of view With the design altered to embody certain modifications to ease manufacture of difficult parts, the planning and time-study departments were called upon to state the manufacturing quantities necessary to produce the article at a works cost of approximately £7 per unit As this proved to be 3000 the works were immediately given a production order for that amount From then on the order was planned and tooled like any ordinary production order, and eventually was put into manufacture on the normal basis accorded to all orders.

Final cost figures produced at the completion of the order showed that the selling-price of £18 was, in fact, slightly high, as the works had been conservative in its original estimate, and in practice had comfortably beaten the target figure of a total works cost of £7 per article

There was, however, a sequel to this case. Within twelve months of the British company's being forced off the market management engineers were called in to advise on what organization was necessary to enable the company to produce at competitive prices, and so gain a share of the rapidly expanding demand which existed for the American-made article. The same company's present-day activities make it extremely doubtful whether it has yet learned its lesson, and even appreciates the fact that the market which was anticipated by the American concern was to a large extent fostered, if not actually created, by the manufacturing policy which it had pursued from the very beginning.

Just as the large American plant has much to teach its equivalent in Great Britain, so also has the small plant equal lessons to offer to those in its category. Foremost among these is the carrying out of correct manufacturing policy. Whereas many small companies in Great Britain, and even many medium-sized ones, are handicapped in efficiency through being jobbing plants of the worst possible degree—the type which is never quite sure what it will be called upon to make next, or where it will come from—the average small American plant, on the other hand, does not pursue this course, but overcomes the obstacles of not having its own special products by aiming at strict specialization. The average business-man visiting the United States is often amazed to find how common this practice really is, and how many of even the smallest and most humble firms confine their activities to specializing on the production of one simple part for a given trade. A policy of this kind produces manifold benefits. By enabling concentration to be made on work of a specific type and class, it provides a basis on which the promotion of efficiency can be readily and continually sought. It also enables a company to become 'production-minded,' and in a position, therefore, to take full and ready advantage of development chances as these appear. By no means least of the advantages afforded by a policy of specialization is that it facilitates the making of plans as well as affording a degree of security which no jobbing work can ever equal. Many British jobbing and general engineering companies which never quite know what the next few months ahead may bring, and which in many cases have an ever-present fear of a possible depression appearing in the offing, would do well to give much thought to the pros and cons of their copying the American example, and forsaking jobbing work in favour of some measure of specialization.

One of the most marked differences between British and American concerns is to be found in the application of general business policy. In America the actions of the average plant are largely governed by, and subordinated to, the one set purpose of securing greater and still greater business in order that it may develop and keep on developing, and thereby one day possibly become a mighty organization of both

national and international repute, capable of capturing and holding world markets of the greatest possible magnitude. This determined attempt to gain the status of the large and mighty industrial corporation—which concern is admired almost to a point verging on reverence—is, indeed, a very live and moving force in the life of the majority of American businesses, including even the most small and humble of companies. Constituting an undoubted aid and incentive to getting things done, the possession of a spirit of this nature is responsible in no small way for much of the success of the average American plant, and the remarkable rate of growth from rank obscurity to one of eminence, which so many achieve. This outlook is supported, if not actually created, by the fact that the privately owned, privately run, family business, which is so common in Great Britain, represents but a small part of industry in the U.S.A., where recognition of the manifold limitations of this type of concern swings opinion and policy heavily in favour of the public-owned limited company. This spirit seems to have permeated even the family business itself, because few indeed are run on the lines of their equivalents in Great Britain, but operate with a goodly measure of public company policy in their make-up. One way in which this manifests itself is the recognition given to the realization that a business, to be successful, necessitates the employment of the ablest possible executives, irrespective of family ties and connexions.

Also of marked contrast in the respective business policies pursued by both countries is the American practice of running their businesses with comparatively youthful men in the highest possible positions, even to being the head of many of the mightiest corporations in the country. That this policy is sound, and has proved itself, is witnessed not only by the overall results of American industry, but by a much more definite testing level—namely, the retention by these youthful presidents and vice-presidents of their jobs in a country where sentiment in business is practically non-existent, and where it is the accepted rule that executives reign only just as long as they continue to show ability to produce results.

One outstanding and highly successful feature of American business which goes unnoticed because its results cannot be assessed by any figures or known measuring-stick is its ability to 'make' men. American enterprise is, indeed, unique in this respect, save with the possible exception of Soviet Russia. The average American company has the gift, and, indeed, the foresight, to take even the greenest new recruit and mould him into an executive of first-class quality and undoubted merit. That it is able to do this, and succeeds so admirably in the process, is due first of all to the possession of sound organization, often referred to in a business as the "system," which readily absorbs the newcomer and leaves him not to flounder in a maze of technicalities and instructions, but offers definite and set lines for him to follow. Greatly contributing to the success of this scheme of things, however, is the plain and unvarnished fact that all within the business, from the latest newcomer to the employee with the longest service, are fully aware that opportunity and promotion is equally open to all,

and that any moment may bring forth decided improvement in the fortunes of those who have shown that they possess the right make-up and have the ability to 'produce the goods' if given the opportunity

The two chief failings of American business happen to be two of British industry's best points. These are weaknesses in inspection and lack of flexibility. The inspection failing lies not in actual lack of knowledge of how to test or to do it properly, but in the way the service of the inspection department is constantly allowed to be overridden by production. American companies are guilty of paying much lip-service to the importance of inspection and how it always has the last word, but in practice this is not the case. Over and over again are the qualms and fears of inspectors as to the suitability of a given piece of work overridden by the vehement case put forward by those concerned with production. The cry of "but it will hold up production" usually has the effect of turning the scales and achieving at least a very definite compromise. Whether the chief inspector of the average American concern knows it or not, he is production conscious to an extent that he is guilty of being repeatedly swayed against his own knowledge and better judgment. Fortunately for American industry these faulty concessions are usually caught before leaving the gates of the factory, but in the interim they are the direct cause of much wasted effort and loss of valuable time.

Flexibility—which means the ability to make quick and easy adjustments to activities to meet rapidly changing conditions, and to provide for ease of future developments and alterations—is a factor in which the average American company is badly lacking in comparison with its British counterpart. Its importance to the general scheme of things can be gathered from the fact that had not a marked degree of flexibility existed in British factories at the time of the Battle of Britain then the subsequent stream of American supplies would have proved of no avail, as this would have arrived too late. True, the needs of industry are based on peace-time requirements and not the abnormalities of war, but then a certain amount of flexibility in industry is just as important and as necessary in times of peace as under times of stress. It is the possession of this factor which allows British companies to produce, for instance, any prototype model in infinitely less time than American companies can manage. The reason is not far to seek. American industry, in producing that admirable manufacturing set-up which is the envy of the industrial world, and which is, of course, so essential to the best type of economic production, is, however, inclined to err on the side of being too tool-conscious, and accordingly to become unknowingly far too rigid in its attitude towards production. American industry, which has given such a great lead to the rest of the world, should watch that its future efforts do not become the stereotyped actions of the automaton, whereby the thinking of its people is inseparable from the employment of huge capital, immense tooling programmes, and machinery and equipment on a grandiose scale—in short, that those responsible for directing its activities do not reach the pitch where they require 'a field to turn round in'.

The Continent of Europe

Comprising, as it does, many nations, each with something of distinct benefit to offer to the industrial world in general, Europe, if viewed as a serious competitor of first-rank status, largely resolves itself into one power—namely, Germany. Little has been written about this country's industrial methods, but a whole lot has been assumed. For this reason it is necessary to stress that little of Germany's vaunted genius for organization shows itself *within its spheres of industry*. Indeed, by no stretch of the imagination can German industry be considered as conspicuous for the remarkable powers of organization which the race as a whole is said to possess. A marked degree of thoroughness there may be, but often even this is contrary to good organization, in that it is entirely misplaced. It is not the intention to convey the impression that German industry is badly organized—far from it, but that organization, at least as applied to industry, is not the national trait that some would have us believe. In point of fact, judged from American standards, German methods are decidedly lacking. A better parallel would be Great Britain, seeing that from an industrial organization standpoint Germany occupies a position between the two, being slightly in front of the latter. This is endorsed by her rating in each of three very different testing mediums—namely, "man-hours per piece produced," "use of the line system of production," and lastly by that judge at least of modernism, "use of the individual motor drive." In each of these does she occupy second place to America, with Great Britain a close third.

German industry in general is certainly far more 'card-index' and statistically minded than any of her competitors. That this is so is an expression not only of the German's natural tendency towards extreme thoroughness, but of Government influence over the individual enterprise. While much of this recording and gathering of statistics is carried to excess, if not entirely misplaced, there is, however, one prominent instance of its use which serves a very fine purpose, and which can well be copied by other nations. This system, which is of fairly general use in the country, is the practice of maintaining a card-index for keeping a check on the wear and tear on all production gauges in the factory. The theme of the system is the ensuring that each gauge in use in the factory is examined on a number of occasions during the length of its useful life. The period between each varies, of course, according to the accuracy of the work on which a given gauge is employed and the extent to which the gauge is liable to excessive wear or damage. On gauges used for extremely accurate work examinations occur at intervals as short as every four weeks.

The average system of this type functions as follows. As a new gauge is put into operation a card bearing all particulars and the date of issue is filed away in chronological order according to the date fixed for its first review. A gauge issued, say, in the tenth working-week of the year, and being of a type which calls for examination every four weeks, would be filed in the section of the index which covered the four-

teenth week of the year. On that date it would be withdrawn in conjunction with all other cards in the same section, and after the gauge had been checked and, say, found correct the necessary data would be recorded on the card, and it would be posted to the drawer of the cabinet denoting the eighteenth week of the year. This procedure would continue until a gauge was either withdrawn from service or replaced. The frequency of the examination period originally set is, of course, open to revision in the light of subsequent experience. That is to say, a gauge set for examination every four weeks which proved to be in first-class order after a number of checks would be lengthened to one of eight weeks or even longer.

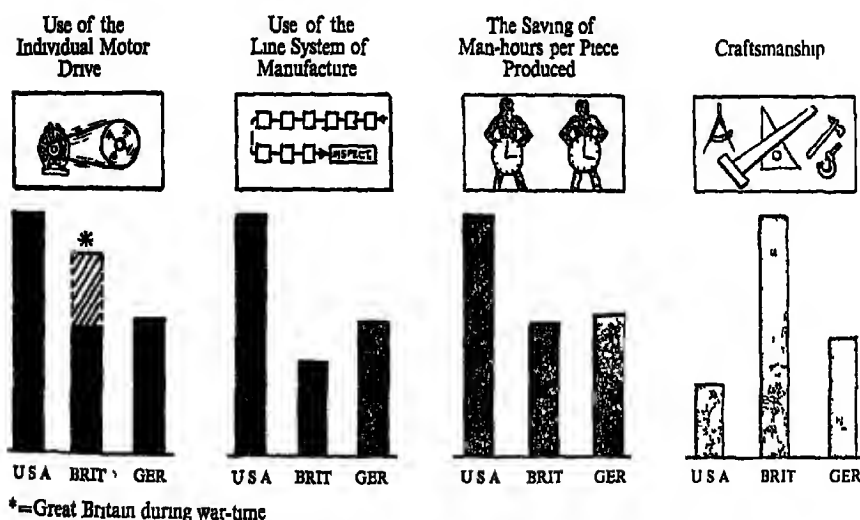


FIG 22 COMPARISON OF U.S.A., GREAT BRITAIN, AND GERMANY FROM FOUR IMPORTANT ANGLES

A system of this type serves an invaluable purpose. Not only does it greatly minimize that highly costly risk of producing scrap as the result of faulty gauges, but it produces most valuable statistics on the length of life of various types and forms. It was, as a matter of fact, due to the experience gained by the operation of a system like this that the war-time innovation of glass gauges came into being.

In one thing, however, Germany stood supreme. This was her attitude towards the inventor. It has been said that Germany encouraged her inventors more than any other country. She did more than this—she even went out of her way to discover them. Industrially her practice in this respect was to go far beyond the half-hearted suggestion-box system, which finds a certain amount of favour in other countries, and seek suggestions and, in fact, specific plans by direct personal approach. Unlike some countries, those responsible for running German factories were not afraid to conceive, and, indeed, readily admit, that brilliant ideas can come from the man down below. It was a large German electrical company, for instance, which, faced with

a problem it could not solve—namely, how to machine-bend a very tricky heating-element—and having engaged its draughtsmen and tool-development engineers on it to no purpose, frankly placed the position before its work-people. The result was that from a source least expected came the entire plans for a really brilliant process, which was responsible for entirely revolutionizing the manufacture of many of the company's products.

Little is, indeed, known about the industrial organization methods of Soviet Russia, except that much of it has been founded on American methods, and has, in fact, been largely installed by the latter country's technicians. What knowledge has been gained of Russia's war-time industrial achievements, however, would suggest that the pupil has greatly profited by this training, and that, as a consequence, much of the country's industry is handled in a very efficient manner. In fact, it never was as bad as some people suggested. Time has shown how badly misplaced, for instance, was the plea and contention of some fifteen years ago that Russia could never be industrially sound because her people were essentially non-mechanical-minded, and were, in fact, the worst in the world in this respect. Certainly proved false since, it was not even accepted at the time by those who had worked with Russian technicians and craftsmen, and who had found, for instance, that among the country's tool-makers could be numbered some of the best in the world. Since then she has undoubtedly progressed to an almost unbelievable extent. What effect this will have on the industrial position of the future is not known, but it would at least appear evident that Russia will be too involved with the development of her own resources to emerge as a serious competitor in the industrial market for many years to come.

Sweden is a country which has contributed largely to scientific development in more than one branch of industry. It is, however, in the engineering trade that Sweden has produced her best technical efforts, and is to-day advancing with an earnestness that promises ill-tidings for her competitors in certain types of products. Complete realization of any aim towards industrial greatness will not, however, be possible until Sweden takes steps to eradicate from her engineering industry a failing which is common to most of her industries—namely, a tendency to concentrate on the technical-design side to the serious detriment of production. In other words, although Swedish technical engineers are outstandingly good, and, indeed, compare favourably with the best that any country in the world can produce, with the result that Swedish designs are high, technical attainments which command the respect of engineers everywhere, no similar attention has been given to production engineering and works organization and management.

Swedish industry as a whole is, indeed, woefully lacking in all matters appertaining to works organization, and particularly that section of it which deals with production planning and control. The cause is not a lack of willingness to organize—indeed, the contrary is the case, as the average Swedish works is extremely keen on this—but to an incorrect understanding of just what is involved in these various activities, and how

they should really function. It appears as though some one in the average Swedish business has gathered an impression from technical literature of such activities as planning, production control, time study, etc., and has taken steps to enforce the formulation of these departments, without really appreciating what each one stands for. That, indeed, appears to be as good a reason as any to account for the fact that so many Swedish companies operate, for instance, planning and time-study departments whose main activities are only very indirectly connected with the titles which the departments bear. A large percentage of industry in the country has yet to learn that planning, for instance, is not the writing out of piece-work tickets, or the putting of orders into the shops, but is solely and simply the means of determining how to do a job, and that it does not cease when all standard lines have been planned, but is for ever seeking out new and better methods of manufacture. When Sweden readjusts her ideas on this subject, and brings her status in production engineering and works organization to anything like that already achieved in design, she will, indeed, be a force to be reckoned with.

On the other hand, Sweden at the present time is far above many countries in the way in which she trains her future technicians. The opportunities provided for technical training, both at colleges and in the average business, are most advanced, and could well be taken as an object-lesson by many countries whose industry is much greater and infinitely longer-established. By no means an inconsiderable factor contributing to the all-round success of this intensive seeking for technical knowledge is the rank and status which Sweden accords to her engineers. The title "Ingenjör" after a person's name is, indeed, one which denotes prestige and standing, and as such is given the greatest possible respect, if not actual admiration.

While the rest of the countries in Europe offer probably less serious competition, each one, nevertheless, has something of value to contribute to the common pool. One fact which is often overlooked in any comparison between countries is that a country is judged by its average and not its exception, and that accordingly even in the country with an exceedingly low industrial rating may be found highly efficient examples of organization in some branch or section of industry.

It was a medium-sized company in France, for instance, which originated the use of visible-control methods. Many years before the method had gained its present-day popularity, and, in fact long before others had even thought of using it, this company had applied one aspect of it in a very useful way. Concerned with the assembly of a number of light products, and arranged on the line system, in which work progressed to completion by being passed by hand from one worker to another working seated at long benches, the company had sought some means whereby it could at all times make evident the amount of production reached at any moment of the day, and thus, in addition to serving its own control requirements, serve as an incentive to the workers to achieve greater output. This is accomplished by fitting an electric trip at the end of each line of benches where the various products reached completion, and connecting

these to large overhead electric indicators, so that as each finished product came off the lines, the accumulative total of each type was clearly registered in large illuminated figures on the indicators. The fact that the amount of production reached at any moment was thus obvious to all proved an undoubted incentive. When, however, the company instituted a bonus system in connexion with it, and offered a bonus each day for all production over a certain amount, the effect was really astonishing. It had the remarkable effect, in fact, of often causing greater production to be achieved during the last hour of the working day than any other. Workers, noting from the indicators late in an afternoon that their bonus was in doubt, or alternatively likely to be small, produced a reaction whereby all set to with a will to achieve the extra quantity before closing-time.

A group of companies engaged in the toy trade in one European country provided a decidedly unusual, if not unique, example of one way of attempting to achieve cheap production. Though forced, like every one else, during the years 1914-18 to undertake some measure of salvage-work, both individually and as a company, these concerns had not forsaken the principle at the conclusion of hostilities, but had continued to operate it under peace-time conditions. To this end they had organized their work-people into competitive, salvaging teams, to which they offered prizes for the greatest collection of salvage in the way of paper, cardboard, timber, zinc, cellophane, etc. So successful was the scheme that a very large proportion of the material used in the company's production came to them entirely free of charge.

While industrial Britain has undoubtedly much to offer to the business world at large, she also stands to benefit considerably from a study of business methods in other countries. "Study the other fellow's experiences and profit from his mistakes and successes," should be uplifted from the category of wise sayings and be firmly established as the guiding principle which all should apply to their dealings with those of other nations.

CHAPTER XI

WITHIN THE COMMONWEALTH AND EMPIRE

IF knowledge of any one overseas market be important to the British people it is surely that of the Empire and Commonwealth. Yet, despite this, there is a great dearth of knowledge among the general public of anything appertaining to the true position in these sister nations. Not only is the man in the street singularly uninformed on the subject, but the same applies to many business-men, including even a goodly proportion of those whose companies have long dealt with these markets or who maintain decided hopes in this direction. Regrettable as this lack of knowledge would be if occurring in respect to some foreign market, it becomes, however, a most dangerous evil when applicable to that very market in which Great Britain's future prosperity is so surely bound. It is in view of this, as well as the general desirability that all should be reasonably well informed of conditions in that framework of nations of which we but form a part, that this chapter is devoted more to a description of ruling conditions in a number of Commonwealth and Empire countries than to an assessment of actual organization achievements in comparison with other countries.

India

Industry is in a far more advanced state in India than the majority of people realize. Indeed, it has progressed so rapidly during the past few years that it now occupies the proud position of being the sixth industrial country in the world. This fact will doubtless come as a shock to a vast body of people who will have need to adjust their mental picture of a country of bazaars and semi-Oriental practices, to one of a country which has already arrived industrially. Although this industrial development was naturally given a decided impetus as the result of war-time needs, it has, however, by no means been one of overnight growth, as the gradual industrialization of the country has been proceeding apace for the past twenty years or so. During this time tremendous strides have been made in the development of many Indian industries, but particularly in the field of engineering. Progress achieved in this latter sphere has been especially noteworthy. It has seen the growth and development of huge iron and steel works of a class comparable with the best of their kind in the world, and undeniable progress accomplished by a host of small, medium, and large plants whose products range from that of the huge engineering project down to the small mass-produced article. In fact, with but comparatively few exceptions, every known class of engineering product is made in India to-day.

That concentration was paid to obtaining progress in the engineering field was not merely due to the fact that it is a staple industry, capable of expansion in so many different channels, but primarily because development in this sphere had become essential to counter-balance the rapid strides which had been made in other industries, both primary and secondary, as, for instance, the flourishing jute-mills, the paper-mills, the tea trade, the railways, and a host of lesser pursuits. That the policy was sound is witnessed by the all-round healthy state of India's present-day industry, and the employment which it directly and indirectly provides for so many of its teeming millions.

Much of the credit for this development must go to the long line of British craftsmen, technicians, and managers, who through the years were sent out from home to establish and develop these plants and train the natives to become satisfactory operatives, craftsmen, and technical assistants. The degree of success which they achieved is evidenced in the remarkable proficiency of native machinists, fitters, tool-makers, draughtsmen, and the like, and the fact that many manufacturing plants in India are entirely staffed and run by natives, without the aid of a single European.

The foregoing constitutes a brief résumé of the background which must be borne in mind by those seeking the Indian market of the future. The would-be exporter to India, however, should not in any way be discouraged by the standard of industry already attained in the country, or the well-known dreams of many Indian leaders—the "India's needs to be met by Indian goods made by Indian labour." India's potentialities as a customer of manufactured goods are as yet comparatively untouched and will assuredly expand in relation to the development obtained within its borders and the improvement obtained in the purchasing power of its people. India's power to import is undoubtedly restricted as the result of the present undeveloped state of much of the country. Not only will opening up of these huge tracts of land in itself provide the need for huge imports, but the eventual fulfilment of this task will have produced a state of society whose day-to-day needs for general commodities will far exceed the amount called for under present-day conditions.

The best achievement of this progress, however, will only be possible provided a drastic alteration be made in the general business policy by which much of India's industry is at present conducted. Unfortunately for India, a large proportion of the business of the country is still controlled by that antiquated trading and business policy represented by the system of 'managing agents.' This system—a relic, indeed, of the days of the East India Company, when the merchants of the day did, in very truth, rule India—although, of course, in no way exercising the power of its early days, even to-day holds great sway over much of the country's commercial and industrial activities. Trade of all kinds, in fact, both external and internal, is essentially still in the hands of a comparatively small number of merchants, who, under the title of managing agents, handle and control so many diverse activities that collectively they are responsible for no mean portion of the total business and industrial life of the

country Herein, in this multiplicity of activities lies the weakness of the system. It is one not only of too great a diffusion of activities but also of distinct encroachment in unsuitable spheres. It has arisen through managing agents, who when all is said and done, are essentially traders, having in course of time thought fit to expand their activities to the extent of assuming responsibility for the actual running of a great diversity of manufacturing enterprises. In this they have been guilty of no half-measures. It is quite common, indeed, to find a single company of managing agents who, in addition to their normal trading activities and the running of a number of separate and profitable side-lines, such as travel-agencies, and insurance of all kinds are also responsible for the direction and actual management of a number of manufacturing concerns of widely different character, such as tea-refining plants, paper-mills, electrical engineering works, galvanizing plants and constructional engineers etc. It is, however, mainly in regard to their connexion with these manufacturing plants that managing agents are basically at fault. Good traders though many of them undoubtedly are, they are, nevertheless, singularly ill equipped to venture into the realms of industry in the production of goods of which they have only a very superficial knowledge.

That the efficiency of many industrial enterprises in India is by no means as good as it should be can, in fact, be entirely attributed to the faulty direction and control exercised by managing agents. This is not to be wondered at—indeed it would be surprising were it otherwise. Obviously in these days of specialization and technical achievement it is beyond the powers of any single organization, and certainly one which is basically a trading organization, to successfully run a number of widely different manufacturing activities, each in itself a highly specialized problem requiring expert knowledge and experience for its correct and proper operation.

India, in order to develop to the best possible advantage must forsake methods as faulty as these, and instead follow the example set by the most highly competitive industrial countries—namely, the fostering of the principle of specialization. Progress on these lines need not necessarily entail application of the principle in its most confined sense—*i.e.* a company's restriction to the manufacture of a specific part or product—but could be one of much greater latitude—namely, one of adherence to a definite trade. In other words, what is so badly needed in India is less of managing agent control over a diversity of pursuits, and more of independently managed companies striving for perfection in a given class or calling. The concentration which this would allow would bring its own rewards, not least of which being a spirit of healthy competition arising from a system of unfettered and unrestricted private enterprise.

On the management side of business Indian companies whether managing agent controlled or independent, have an excellent practice which could be copied with distinct advantage by companies everywhere. I refer to the very fine use which is made of junior staff. The keynote of this is the accepted way in which high responsibilities are placed on the shoulders of exceedingly youthful staff-members and executives.

It has been said that India breeds the ideal executive from among its youthful European recruits. Be this as it may, it is, however, a fact that many of the present-day highly placed executives of British industry and of other countries are men who in their early days served in India. Here, due mainly to the greatly restricted use of highly-paid European staff, the newcomer, probably just out from home, is given such heavy responsibilities to carry that he either sinks or swims. Many do fail and are sent back home, but those who survive this hard test gain rapidly in knowledge and experience, and, due to the fact that there is no better teacher than responsibility, greatly widen their outlook and understanding in the process, and accordingly develop to a high degree the qualities of a successful administrator—namely, confidence, initiative, and personality.

In the use of 'systems'—that often very disconcerting factor in even the best of organizations—India in the main is very sound. She has need to be, for the usual type of system which is capable of being reasonably well operated by workers of Great Britain and other countries is comparatively useless in India, where illiteracy is rampant and where the general body of the rank and file are unable even to read and write. Under these conditions systems must of a necessity be as fool-proof as possible, and aimed at the complete elimination of the 'personal element'—that very variable and often completely undependable factor, the frailties of which to a large extent determine the degree of efficiency obtainable from the systems operated by British, American, and Continental labour. Of great importance, therefore, to these latter countries is the fact that manufacturing plants in India have accomplished much in this direction. The line of attack has been that prompted by necessity—namely, the need to eliminate wherever possible those 'bits of paper' which have to be read, filled in, checked, recorded, and passed around from one person to another. That Indian companies have succeeded in obtaining a drastic limitation of all kinds of paper-work, and thereby eased the chief points at which matters in any system tend to go awry, should serve, indeed, as a distinct object-lesson to those many plants in other countries where the position is decidedly the reverse.

Australia

Two factors which have for long retarded the growth and correct development of Australian industry are lack of capital and an exaggerated sense of trade unionism on the part of the Australian worker. Irrespective of what political issues may be involved in the first point, the essential fact remains that far from sufficient capital is being utilized in Australia for the promotion of industry, especially inland, away from the narrow coastal strip which houses nearly all the population of the Australian continent. The need for it is great, especially in view of the ever-constant drive for immigration. It is, indeed, futile for any British government to plan and strive for an influx of immigrants, without at the same time taking necessary steps to influence

the necessary capital in the country to build and expand its industries. Such a statement should not in any way be construed as being an inference that Australia should be made first and foremost an industrial country—far from it. What is meant by this is that the correct future development of the country is dependent upon a considerable amount of primary and secondary industry being carried out on the spot. Essentially true also is the fact that the establishment of these industries will assist rather than deter the general well-being of the country's basic agricultural and kindred pursuits.

It is, however, abundantly clear that the promotion of the best possible conditions, and the establishing of Australia on a sound economic basis, is not possible without first securing a drastic alteration in the outlook at present held by trade unionism in the country. This organization's continued refusal to accept the working conditions of their fellow-workers in U.S.A. and Great Britain reacts with grave disadvantage on the country as a whole. This is particularly noticeable in two ways: firstly in that it creates a general air of doubt as to the wisdom of attempting to develop the country's industries, and secondly that this attitude of trade unionists is responsible for causing the cost of production in Australia to be considerably higher than that of other countries producing at a high cost.

The Australian workers' attempts to maintain a high standard of living, although most praiseworthy, and one to be given every encouragement, is, nevertheless, distinctly unsound if at the same time allied to a complete disinclination to accept the obligations which assuredly go hand in hand with the realization of a high economic standard. This state of affairs is clearly exemplified, for instance, by the fact that although there is a distinct wish on the part of Australian workers to copy the American mode of life, this copying is more or less restricted to the securing of the benefits to be derived from the American set-up—*i.e.*, high wages and general good standard of living—and does not include likewise acceptance of the working conditions which make these advantages possible. Summed up, Australian workers desire the advantages but not the obligations. This is apparent in two ways: firstly by the opposition shown to the use of methods which make for good organization—namely, such matters as time and motion study, and secondly by the strong disinclination of the average Australian worker to produce to anything like the same extent as his American equivalent. Australia is not alone in this respect, workers of many countries, including those of Great Britain, have yet to realize that the good wages earned by American workers and the five-day working week of eight hours a day which many enjoy is the result not simply of good management and superior organization, but in no small measure the advantage afforded by the willingness of the American worker to produce. Many, indeed, are the instances which go to prove that the latter produce far more in forty hours than workers in many countries produce in fifty hours or more. The Australian worker, therefore, in rightly seeking for a short working week and a good living wage, must, however, realize that these points are purely and simply a question of economics.

and that good production per person per hour is an absolute essential requirement for the attainment of either

The hitherto failing of the average Australian worker in this respect has been mainly the result of faulty theoretical reasoning, because by no stretch of the imagination can he be considered as being incapable of working consistently or inherently lazy. Indeed, the contrary is often the case, because he is extremely guilty of accomplishing by the hard road of heavy manual labour that which by relaxation of certain water-tight union restrictions could be much more simply and easily produced. As a case in point, his objections to time and motion study, and a number of similar matters which are accepted by workers in other countries, is responsible for the maintenance of obsolete ways of producing, which not only involve heavy manual labour, and consequently completely unnecessary fatigue, but is also one of the chief causes of Australia's extremely high cost of production.

Probably the worst of the restrictions imposed on industry by the trade unions, however, is that contained in the strict rules of demarcation which are applied in the large factories, the public services, the railways, etc., to define the extent of the work of various trades. Indeed, so rigid is this application of demarcation, and so wide and varied are its ramifications, that not only is its strong enforcement a primary cause of much labour trouble throughout the country, but, worse still, it undoubtedly acts as a deterrent in many ways to the adoption of new and improved methods of production. Although it would require the giving of a goodly number of instances to convey a comprehensive picture of the total over-all effects of this evil on industry in general, the position, nevertheless, can perhaps be summed up by the quoting of one example—namely, the experiences in this direction of a medium-sized Australian general engineering company.

This company, being desirous of stabilizing its turnover by undertaking the manufacture of certain standard lines in addition to its regular work of a general engineering and jobbing nature, put on the market a small number of new products for which it was known that a good demand existed. Time, however, proved that the manufacture of the said articles required drastic improvement from a price-cheapening angle, as the expected demand had failed to materialize owing to the fact that the selling-prices had proved some twice as dear as the cost of identical goods landed in Australia from U.S.A. Not dismayed, however, the Australian company proceeded to vet its methods with a view to discovering a mode of manufacture which would enable it to market at a price much nearer to the American figure. In this it proved successful. With alterations to design, and a thorough vetting of each and every operation and process, it was able to devise a scheme of entirely new manufacturing methods which, although not capable of allowing production at a figure to give a selling-price equal to that of the American-made articles, which were of course based on greater-quantity production, would nevertheless be sufficiently near to the American prices to allow patriotism for Australian-made articles to take appreciable effect. Commencement

of production on these lines, however, soon came to an abrupt halt, as first one and then another of the new processes were objected to by the trade unionists on the grounds of demarcation. Indeed, objections were raised to so many instances of work being allocated to certain types of tradesmen which had previously been done by others that the affair dragged on so long that the company eventually gave up all idea of marketing the new products, and, in fact, completely discontinued their entire manufacture.

Although the former case, which is by no means an isolated instance, occurred a good few years ago, and it is known that since then some measure of improvement has been forthcoming, it is, nevertheless, evident that Australia still has need for a far wider and better understanding of the economics of industrialism, as well as for a more closely bonded relationship between employer and employee. The achievement of such an understanding would not only remove the types of draw-backs referred to, but would put Australia well on the road to the successful achievement of that measure of industrialization which she so badly needs, and without which the full and best exploitation of the country can never be accomplished.

One outstanding quality possessed by Australian industry is the astonishing versatility of its workers. In no country in the world, in fact, is the average man capable of doing so many jobs, and doing them well, as in Australia. The outcome of the rugged independence of the Australian, who has had need to fend for himself in so many different ways, this versatility is more than an advantage of which the small plant makes full use—it is, indeed, its very life-stay. Particularly is this so in all branches of engineering. That the average small Australian plant thrives at all is, in fact, due to this undoubted quality of its workers. Unlike more industrial countries, the average Australian engineer is not a specialist, a fitter or turner or a tool-maker, he is, indeed, an all-rounder, capable of doing an excellent job in each of many different classes of work. A day in the life of the average Australian engineer in any one of these numerous small jobbing plants is, indeed, a most bewildering affair to the average British engineer's fitter just out from home. The latter finds, for instance, that fitting, besides including a considerable amount of machine-work, may, and more often than not does, include such matters as repairing the roof of the building, undertaking repair to all classes of machines, the making of various types of tools, the repairing of the smithy forge, the laying down of a concrete path, the installation of water-mains, a considerable amount of blacksmith's work, and, in fact, any one of a host of widely different jobs which may occur from time to time.

As will be noted from the foregoing, the opposition which is shown in the large concerns and public-owned enterprises to anything approaching encroachment by one type of tradesman on work classified as belonging to another, is at complete variance with what happens in the small plants, that host of concerns which form by far the major portion of present-day Australian industry. Any policy of demarcation, then, is not only contrary to the best interests of a young and growing nation, but is also opposed to the utilization of the inherent characteristics of the country's workers

It is surely by the fullest and best use of the latter that the hope and salvation of any country can be found, and especially one whose foundation-date is so comparatively recent

It has been argued by some that versatility has no place in modern present-day industry. This is an entirely false impression. True, modern industry, calling as it does for a marked degree of specialization, tends more and more to restrict the use of workers to specific tasks, but even so the need for the skilful and versatile worker diminishes not, and is never likely to do so. It will exist not only in that wide range of plants which by reason of the nature of their activities can never become fully specialized, but it will always exist also in the heart of the highly specialized plant itself. The most fully specialized mass-producing plant yet devised has need for the versatile worker not only in its tool-room, its maintenance section, or machine repair, but also on the production lines themselves. There is perhaps somewhat of a general misunderstanding with regard to the actual functioning of the latter. No production-line set-up yet devised runs like clock-work, entirely free from interruption. Break-downs, modifications to design, new models, absenteeism of employees on account of sickness—these and a host of similar contingencies create day-to-day problems on the production lines which can only be overcome by a measure of flexibility in the plant and the possession of no mean amount of versatility among the productive workers. The ordinary production operator, therefore, who happens to be versatile is, indeed, a god-send to even the most highly organized mass-production plant.

Australia's opportunities are indeed unique. Fortunate in the possession of such highly versatile workers, a great new country to develop, and a grand climate to do it in, she is well set to produce that community of life which all within her borders so keenly desire, and which should, indeed, become the envy and the admiration of the entire world. To be successful she needs but to learn to harness matters, to curb impulsiveness sufficient to profit from the mistakes and successes of older- and longer-established countries, and to overcome the little teething troubles of industry which can rightly be expected in one so young among nations. This done, she should, indeed, venture forth as a perfect example of how economic security, social order, and a first-class standard of life, can be welded together for the good of a country in general, and the particular benefit of each and every one of its inhabitants.

South Africa

In a new country one has naturally to expect a stage of transition. To a large extent this is true of South Africa, where the comparatively recent establishment of a number of large and medium-sized plants marks a radical step forward in the industrial life of the country, which hitherto was of most modest proportions and, in fact, almost entirely represented by the existence of a large number of small and only too often ramshackle businesses engaged upon work of a jobbing nature. That this

transitional stage has not been accelerated by the advent of keen competition has in no small measure been due to the fact that the outstanding wealth possessed by certain regions of the country has in itself constituted a bar to progress by dispensing with the need for that incentive to all worth-while enterprise—namely 'production at a price'. Particularly has this applied in that vastly wealthy area of Johannesburg and district, the centre of the Rand gold-mines of the Transvaal. Here, owing to the fact that all trading and business activities are, in reality, governed by, and subservient to, the particular needs of the gold-mining industry, whose munificence is by no means sparing, but to the contrary is aimed at the promotion of the all-round prosperity of the community as a whole, competition and its resultant economic manufacture as known overseas is practically non-existent in any form whatsoever.

The result of this policy has been to encourage in the area the existence of a host of small businesses, particularly engineering jobbing concerns, the majority of which work in such Heath Robinson fashion that it is not surprising that the cost of production is greatly in excess of the value of work done, and is, on the average, several times greater than the cost at which companies in other countries could produce the same articles. This was, indeed, proved most conclusively quite recently when, in order to satisfy certain South Africans who disputed the correctness of this contention, a sample case was taken, and two small jobbing shops, one in U.S.A. and one in Great Britain, were requested to estimate the manufacturing cost on a basis of man-hours which they would require to produce 'one off' of a certain large-diameter split driving-wheel as frequently manufactured in a similar-sized jobbing-shop to their own in South Africa. The figures thus obtained, when transformed to a common basis, showed that the over-all times required by the respective countries were of the following ratio to each other: Great Britain 1.0, U.S.A. 1.150, South Africa 2.380.

Subsequent analysis proved that this considerably longer manufacturing time required by the South African company—one almost of two and a half times greater than that of the British company—was due not so much to slowness of workers as to the practising of old-fashioned manufacturing methods. The actual methods used were, in fact, practically identical with those which were in vogue in Great Britain when the Britishers in the South African company's employ left their homeland some twenty years previously. A comparison of further jobs of a more simple nature proved that although the margin between the South African and the overseas companies declined as the work involved became less intricate, it rose again whenever quantity-production became involved. In fact, so constant was the South African time per piece for quantities ranging from 100 to 500 articles, that it was obvious that the larger quantities were being estimated on exactly the same basis as the smaller lots, and that the very slight reduction per piece given for the larger amounts was in no way the result of an intended change in manufacturing technique, but was simply an allowance given for an anticipated quickening of production as workers gained extra proficiency as a result of familiarity. On the other hand, the British and American

times per piece manufactured fell rapidly as production quantities increased, and allowed more mass-production-minded methods to be employed

From the cases quoted it will be gathered that if South Africa is to progress industrially she must improve her manufacturing methods to a standard somewhat more in keeping with those ruling overseas. In the case of a young country leeway of this nature is only to be expected, as improvement usually goes hand in hand with that of normal development. As far as South Africa is concerned, however, one feels doubtful if sufficient incentive exists within its borders to foster the drive necessary to attain this end. This impression is gained as a result of the very evident disinclination of people out there to profit by the experiences of other countries. This is made noticeably plain on many occasions and from many different angles. Not only does she fail, for instance, to give production organization its correct place in the general scheme of things, but she even goes out of her way to ignore it. This was amply illustrated but a few years ago when South Africa alone of eight nations turned down a series of highly informative articles on "Industrial Organization," as written by an international authority on the subject. The reasons advanced by the South African publications to whom the articles were offered were to the effect that it would be a sheer waste of time to publish them in South Africa, as the subject-matter would be completely unappreciated save possibly by the odd individual. Then followed the comment that if the author would like to change the articles to some more important matter, say, technical papers on mechanical engineering, he would be offered very good nights for their publication.

It is doubtless due in no small measure to this lack of interest in organizational matters that South Africa has such an acute shortage of the right type of business executive, or of men with leanings to that end. Without a lead in this direction, the young man naturally turns to use his gifts in other channels. Here he is given no uncertain guide. South Africa, surprisingly enough, is extremely 'degree' conscious, and pays great homage to the possession of high scientific and technical qualifications in electrical or mechanical engineering. This is most praiseworthy, but to concentrate on this to the complete exclusion of all matters connected with the field of production engineering and factory organization is a sure way of for ever curbing the best development of the country's industrial pursuits. South Africa has yet to realize that works organization and management, for instance, is a far wider and greater subject than is shown in the syllabus of any examination held by a purely engineering institute.

One unhappy feature about South African industry and, in fact, of the entire life of the country, is the existence of keen racial antagonism. Unfortunately only too often is ability for a given post ranked as of secondary importance to that of race, or at least to proficiency in bi-lingualism. As in addition to this conflict between Boer and Britisher South Africa has an ever-present native problem—one largely a question of where or how to allocate the natives a place in the general scheme of things—it is evident that South Africa's prime and urgent necessity is for proportional

industrial development. Indeed, it is only by this means, by offering considerably greater scope and opportunity to Boer, Britisher, and native alike, that these racial questions can be eased to a point where saner judgment, tolerance, and understanding may come to the fore, and help to promote that lasting union and sense of comradeship on which the country's future so surely depends.

As a preliminary to any move in this direction, however, South Africa must needs first recognize the value of organization, and accord it its due measure of importance. Given this, not only must her colleges teach it, but her business-men must go out and study its workings in other lands. From such a course of action would come many benefits, not least of which being a marked improvement in efficiency from her industries through her people ever asking themselves the question, "What's wrong with our factories, offices, and works?"

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